SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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IMPROVED FLOATING GRAIN ELEVATOR.

The problem of how to effect a rapid transference of goods to and from ships has been very successfully solved during the past few years, especially in the case of grain, for by the aid of elevators and conveyers it is now removed with great rapidity and economy. Fixed elevators, however, necessitate the berthing of a ship alongside the warehouse to which they are attached, and it has therefore during the past few years become the practice to use a portable elevator, by means of which a cargo can be unloaded and placed in any shed alongside of which a ship may be moored.

The first type of portable elevator was one which could be lifted from a barge and dropped into the hatch, motive power being derived from an engine placed upon the deck of the ship, and obtaining steam by means of a flexible tube from a boiler carried by the barge. The use of elevators of this description has enormously increased, as is evidenced by the fact that in 1881 81,951 tons of grain were unloaded by their use, while in 1887 745,090 tons were so discharged in the two ports of Glasgow and Liverpool. These elevators are arranged to have two legs, so that they are practically duplex, and lift the grain from each side of the ship simultaneously, thus keeping it in even trim. By stopping the operation of one leg, a ship which has a list can be brought upright. It is not, however, with the portable type that we have so much to deal as with a development of that idea which is embodied in a floating elevator. A machine of this class is here illustrated.

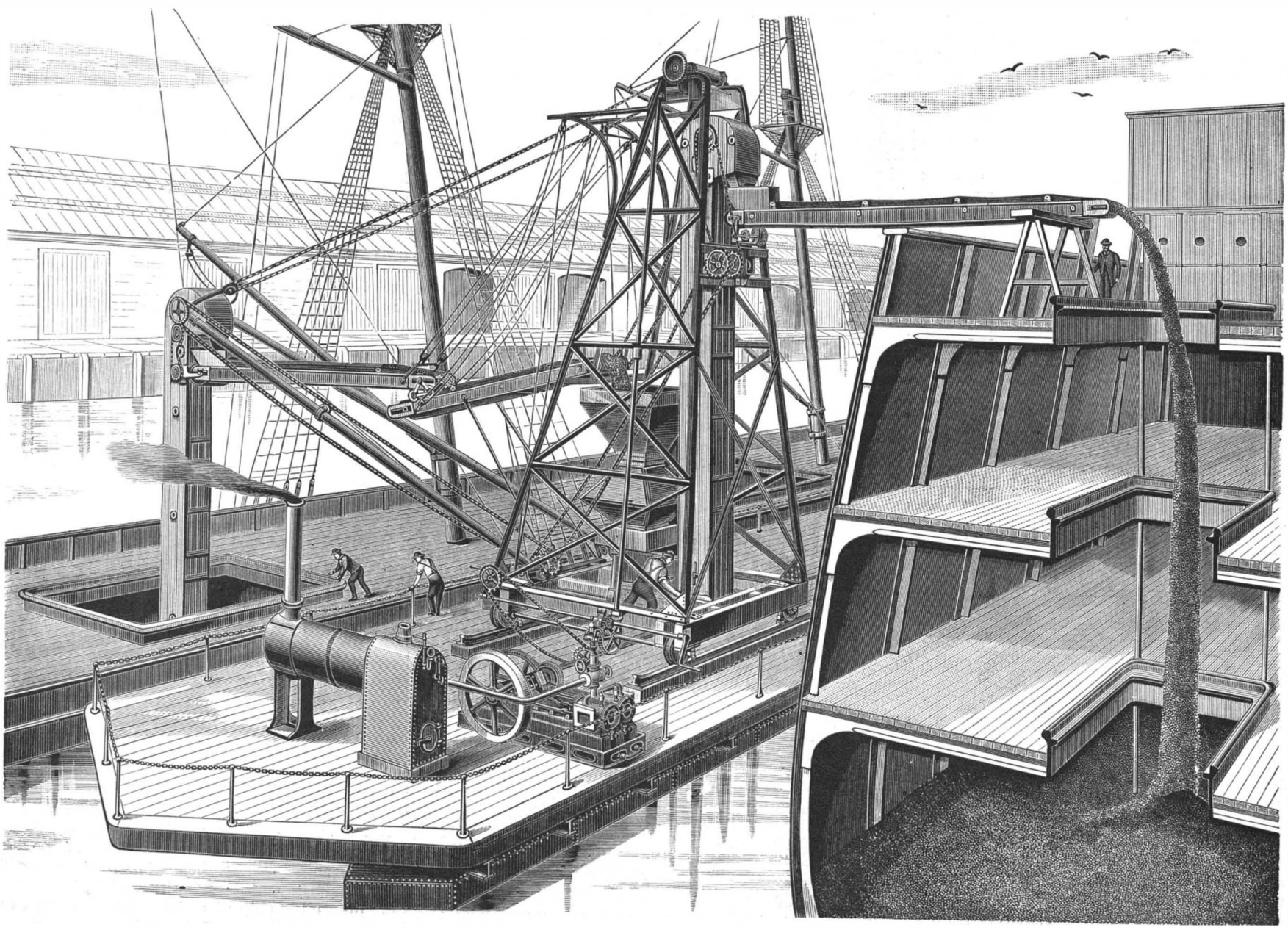
It will be seen that the elevator is carried by a barge or pontoon moored alongside the vessel to be unloaded, and which also contains a steam boiler to supply the necessary power. The upright column is a double one —internal and external—the inner one being fixed to the lower base plate or foundation, and the outer to the upper plate. Between the two plates a set of rollers are placed, so that by means of a hand winch the case and bridge can be revolved, as is sometimes necessary in order to suit the position of a vessel and to house the elevator. At the upper end of the pillar two H-section girders are attached, which form a bridge or jib for carrying the elevator trunk. In addition to having freedom of circular movement, the bridge can be raised or lowered at the point or nose, as desired, by means of the wire stays attached to the short end of each girder. This provision is made in order to allow of the elevator trunk being easily placed to suit the delivery, and also to facilitate the housing of the elevator, as will hereafter be described. The requisite power is obtained by means of the winding barrel shown. The elevator trunk is carried in a light wrought iron frame, through which it can slide, the frame being in turn sustained by trunnions, which enable it to be oscillated when necessary.

In addition to the oscillatory movement there is also provision for moving the frame and trunk longitudinally on the bridge, by means of a traverse screw worked by a hand chain from the deck of the pontoon or barge. The range of longitudinal movement is, of course, limited, and is only intended to compensate for the variations existing in the beams of ships. To the head of the elevator leg or trunk is attached a wire rope, which passes over guide pulleys to a barrel, driven by gearing from a pair of engines fixed to the upper plate. By means of this the trunk can be drawn into a horizontal from the vertical position it is in when raising grain. A further lifting rope is taken from a third winding barrel, also driven by clutch gearing, and attached to a ring bolt at the lower end of the elevator case. In this way the latter can be vertically raised or lowered out of or into the hold of a ship, and can thus easily follow the height of the cargo as the latter is unloaded. Two pairs of steam engines are fixed on the revolving base plate, by which the whole of the motions are controlled, one pair driving the three winches described, and the other the elevator and conveyers.

The elevator trunk or leg is fitted internally with two endless chains, running parallel to each other over pulleys at the top and bottom, and to which are attached at short intervals steel buckets. The necessary motion is communicated to these chains by means of pitch chains of special construction, working on sprocket wheels, the chain from the engine driving a second one placed on a shaft running alongside one of the bridge girders, and so communicating motion to sprocket wheels, which drive the elevator and conveyers. This method is clearly shown in the illustration. Attached to the elevator head is a telescopic delivery pipe, by which the grain is delivered to the conveyer band. If it is necessary to have more than one length of conveyer, a sprocket wheel is placed on the spindle of the roller at the extreme end of the first length, driving a similar wheel on the first roller of the second length. The distance to which the conveyers may be extended is thus very great, the whole of the power being derived from the engines on the pontoon or barge. The sprocket wheel and chain arrangement are of special design, easily detachable, and very convenient.

We had recently an opportunity to inspect a machine of this class which is being supplied to the Limerick corporation, and we can testify to its easy and efficient working. We have referred to the housing of the elevator. This is requisite when it is out of use or when the machine is being moved from place to place, and is effected in the following manner: A cargo having been discharged, the leg or trunk is, by means of the lifting winch, drawn up clear of the ship's hatch. It is then drawn round until it lies on the bridge, which is swung round until it is fore and aft of the barge, being then allowed to fall at the nose, until the latter rests on a trestle placed on the deck of the barge, the whole being then made fast. The gearing, etc., is then closed up, and the barge is then ready for transportation without any fear of accident.

The buckets are stamped out of steel, cooper, or brass



IMPROVED FLOATING GRAIN ELEVATOR.

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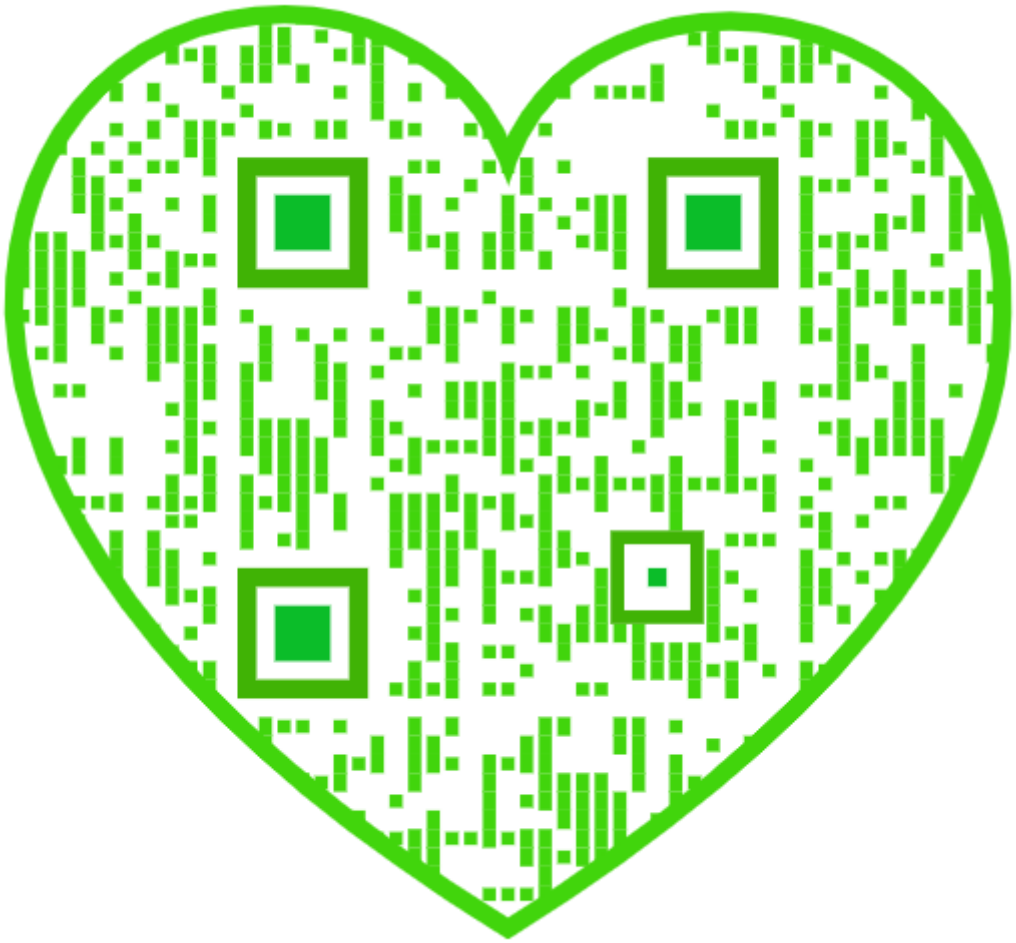

sheets in one piece, and even in the largest sizes are without a joint. A special plant has been laid down by the makers for this purpose, and they now make a large number of various sized and shaped buckets. The arrangement of these on the elevator chains is such that the maximum duty is obtained, as no space is lost in any way. Each machine is arranged to raise 50 tons per hour, but can, if necessary, raise 60 tons. The whole arrangement is most complete, and the machine we inspected worked well and was well constructed.

Our illustration represents a machine constructed for the transference of grain cargoes from large barges to ocean-going ships, weighing it in the process. This machine was made for use at Odessa, the grain arriving at that port by large sailing barges. As will be seen, one elevator leg is sustained at the end of the jibs or derricks, and raises the grain from the barge and delivers it to a conveyer. The latter empties it into a weighing machine placed on the pontoon carrying the elevator, which automatically weighs it, and delivers the grain so that it can be raised to the second elevator, which is carried by the upright frames shown. The second elevator delivers the grain to a conveyer. by which it is dropped into the ship.

The makers are Messrs. S. S. Stott & Co., of Haslingden, near Manchester.—*Industries.*

The Fastest Railroad Train in the World.

Competition between two of the great English lines of railroad has recently taken the form of cutting down the running time. The London and North-Western and the Great Northern, striving against each other for the traffic between London and Edinburgh, have reduced the running time between these points to eight hours. By the first named road the distance is 401 miles, by the other it is 397. For the entire distance the schedule is slightly exceeded by the short B. & O. run between Baltimore and Washington, 40 miles in 45 minutes. But the length of the trip removes it from the comparison. On the North-Western road one run without a halt of 158 miles in three hours is a part of the trip. This exceeds the run from Fort Wayne to Chicago by 12 miles. To realize what this speed means, it may be compared with the trip from New York to Chicago by the Pennsylvania Railroad. The same speed would reduce the time between these points to a little over eighteen and one-half hours. It has been suggested that an afternoon train should leave New York and should reach Chicago in time for business the next day. The above proves the practicability of such a project.

Clouds of Moths.

The city of Reading, Pa., had a remarkable visitation of moths on the evening of August 1. Myriads of them infested the air, resembling at a distance a snow storm. They were first noticed flying around the electric lights about 8 o'clock, and gradually increased to such numbers as to obscure the brilliancy of the lights. Passengers on the street cars, as they passed under the lamps, were covered with the insects, and handkerchiefs, hats, and fans were plied vigorously to keep them off. Fires were built under the lights and heaps of the moths were burned. Penn Street saloon men were compelled to close their front doors to keep out the pests, which were attracted to the barrooms by the bright lights. The doors and windows of dwelling houses had also to be kept closed to keep them out. Local savants pronounced them cotton moths, and they evidently came from the South. They are said to precede a hot wave, and a decided rise in the temperature is predicted.

At Easton, Pa., butterflies by the thousands flew around the sixty-four electric lights, lit on the carbons and then dropped dead in the globes. When the men who renew the carbons visited the lights, they found on an average two quarts of dead butterflies on each globe, a total of four bushels, besides the lot that had fallen on the ground during the night.

Moths Attracted by the Electric Light.

A curious and interesting spectacle is now presenting itself upon Third Avenue, New York. Myriads of moths are circulating around the electric lamps upon the corners of the street, their shadows being projected upon the sidewalks and opposite blank walls, as if upon the screen of a magic lantern. Passers-by are startled at perceiving these apparitions dart across their path, and stand gazing astonished at the novel sight. The moths are barely a half inch long, but appear projected at least two feet, with outstretched wings in proportion.

THOMAS LATHAM.

A $50,000 Horse.

A remarkable auction sale took place on July 31, at Lexington, Ky., on the occasion of the sale of the celebrated three year old stallion Bell Boy. This horse had a record at three years of 2:26, and was bought four months ago for $35,000 by Jefferson & Seaman. To close the partnership, the animal was again sold as above, and brought on the block the large sum of fifty thousand dollars, the largest price every paid for a horse in this country. The purchaser of Bell Boy was C. E. Seaman.

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GEN. PHILIP HENRY SHERIDAN.

On August 5, at 10:20 P. M., Gen. Sheridan passed away. His death, following upon the demise of Gen. Grant, removes another of the great leaders of the United States army in the civil war, and acts to still further relegate the conflict to the domain of history.

Gen. Sheridan's parents were natives of Ireland, and emigrated to this country about sixty years ago. He was born March 6, 1831, in Somerset, Perry Co., Ohio, about twelve miles from the birthplace of Gen. Sherman, his companion in war and his survivor. His family were of pure Celtic blood, and many of the characteristics of the race are said to have appeared in Sheridan, especially in early life and during his West Point career. He graduated at West Point in 1853, and was sent to Texas, where he began his experience as a soldier in fighting the Apache Indians. Until 1861 he remained in the West. On the breaking out of the war he was assigned to various duties, principally clerical and in the quartermaster's department, until May 25, 1862. Then he took command of a regiment of cavalry, the Second Michigan, and at once began his brilliant record as one of the most daring commanders on the Northern side. His magnificent achievements at Winchester and elsewhere are matter of song and history.

In 1870–71 he was with the German armies, and witnessed many of the scenes of the Franco-Prussian war. He was often solicited to enter the field of politics, but persistently refused. In June, 1875, he married, and now leaves a wife and four children to mourn his loss. His quiet and retiring disposition serves only to make the memory of his actions in war the more enduring.

THE MECHANISM OF THE COUNTER ATTACK.

With the coming of quick-firing arms and more destructive engines of war, tacticians are looking with more favor upon the feasibility of the counter attack, especially where a small force is operating against a larger one, being, as one might say, upon the defensive, and in this humor, allowed by the enemy to choose its own battle ground. It will be remembered that the French, in the early days of the Franco-German war, occupying this latter position, invariably organized a counter attack and generally after the enemy's ranks had been terribly mangled by the play of the mitrailleuse. But the French, peculiarly fitted as they are for offensive rather than defensive operations, rarely followed up their advantages, and later on, the Germans, adopting the same tactics with better organization, kept a force in reserve to oppose the counter attack, which, had the French been less discouraged, would doubtless have proved tardy, if, indeed, at all availing. At least this is alleged in a recent paper of great interest by Major W. M. Smith, of the Royal Artillery. There is an extreme school of writers on the conduct of war with the new arms who insist that to occupy the "weak intervals" of the battle ground with anything beyond a mere "screen" or outpost line of infantry is a waste of strength needed elsewhere. The element in which lies the source of strength is, according to Major Smith, the extent of the fire-swept glacis in front of the position, and the intensity of the hail of iron and lead that can be poured over its surface. The enemy, he says, must be compelled to cross that zone, and to suffer the utmost penalty in doing so, and for this purpose the frontal fire of infantry must be a maximum in volume and in its lateral extent without a break or even a quaver. All military readers will recall Napoleon's famous plan for "piercing the center"—a system which now has fallen into disuse; the "pivot and interval" system rendering it abortive, though doubtless a Napoleon could still break the line with it, as Epaminondas used to shatter the strongest line with a steel-tipped wedge of warriors.

TORPEDO WARFARE IN PRACTICE AND THEORY.

Captain Greenfell, late of the Royal Navy, having large experience with and little confidence in the locomotive torpedo, recently gave his conclusions to the Royal United Service Institution, where were many with equal experience ready and able to confute his most serious charges. Captain Greenfell thinks the big gun, such as modern ships carry, far more effective than the torpedo, the former having a battering range of from three to four miles, and the torpedo an effective range of only 500 yards. As to accuracy, he says: "Captain Gallway (an authority) speaks of a torpedo as being extremely accurate which showed a mean error at 400 meters of 2·4, say 94 inches, laterally, the depth being always within a small decimal of that at which the torpedo was set to run. Any modern gun will do for comparison. I take the first which comes to hand—the 24 cm. 30 caliber long German gun. At a range of 2,000 meters (five times the other), its mean error is vertically 16 inches, horizontally 8 inches."

But Captain Greenfell admits it were impossible to train big guns on a moving torpedo boat, and with another big ship in sight, belonging to the enemy, the fight would be equal. But the torpedo boat is looked to to take a big ship at a disadvantage, and we quote his own authority. Captain Gallway says that machine guns, which are looked to to beat off torpedo

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boats, are utterly unreliable in quick training. He says: "I know of only one occasion in which they have been tried in actual war. I hear from an officer out in the Min River, that a boat approached the French fleet in the night, the electric lights were turned on to her, and all the Hotchkiss guns of four ships were brought to bear on her, yet, in the end, they had to send two steam pinnaces to bring her alongside, and then they found she was not even hit!"

During the discussion of Captain Greenfell's paper it was shown that a torpedo boat built by Herreshoff, of America, was fired at by one of the big ships in Portsmouth Harbor, England, for a whole day without sinking her. Also that, on the Danube, a boat carrying a spar torpedo was actually discovered and a very heavy fire opened upon her, yet she kept on and delivered her fire. And an instance was cited, where a big ship, with torpedo netting set, in the Mediterranean, and looking for them, did not discover their presence till they were under the netting and against the hull. It was shown that a small explosive force, under or nearly under the ship, has a far more forceful effect than many times its quantity above, having, indeed, the water for a gun; the resistance of the water being greater than that of the ship.

From the great mass of testimony brought out by this discussion, we might fairly sum up as follows:

1. Torpedo boats, to be effective, should be operated in fairly smooth water.

2. The torpedo boat, advancing end on, has little to fear from the machine gun, even in broad day.

3. The discharge must be below rather than alongside the hull.

4. Several torpedo boats should be set to attack a single great ship, instead of leaving it to one.

Experiments in Feeding Sheep.

We have received Bulletin No. 2 of the State agricultural experiment station, Cornell University, Ithaca, N. Y. It gives the results of some experiments in feeding sheep to determine the economic value and the effect on health and digestion of foods rich and poor in nitrogenous compounds. We make a few abstracts:

From a flock of about 100 lambs, six months old, six were chosen with great care with reference to uniformity in size, weight, and shape. They were of mixed Cotswold and Southdown blood.

Their food from weaning to October 10 had been grass alone.

On the above date they were shorn and all placed together in a box stall and prepared for the experiment by being fed hay, and at first a small portion of corn meal and bran, which was gradually increased, until it reached, on November 11—when the experiment began—about ¾ of a pound per head.

From this time on they were divided into two lots of three each, in such a way as to make the total weight of each as nearly equal as possible. They were provided with warm stalls on the ground floor of the barn. In order to make the feeding rations different in character, Lot 1 at the beginning of the experiment was fed daily 1½ pounds of oil meal and 1½ pounds of coarse wheat bran. Later on in the experiment, in order to make the nutritive ratio still narrower, one pound of cotton seed meal was substituted for one of bran. We will call this the nitrogenous lot.

Lot 2—the non-nitrogenous lot—was fed 3 pounds of corn meal daily.

Both lots were fed good mixed timothy and clover hay, great care being taken to give them only so much as they would eat up clean.

All ate their rations with avidity up to near the last of December, when that of Lot 2 had to be reduced for a short time to 2 pounds, and later on for three days they received nothing but hay, as they refused to eat their corn meal; it was not until March first, when 4 pounds of mangolds were added to the rations of both lots, that they could be induced to eat their full ration.

According to the German standards of feeding rations, one to four is the narrowest (that is, *one part* of protein, or muscle producing food, to *four* parts of carbohydrates or heat and fat producing) and one to seven the widest ratio advisable for the purpose of fattening sheep. Since the nutritive ratio of the food of one lot was below the lower of these ratios, and that of the other above the higher, it is natural for us to expect very marked results. These results were noticeable almost from the beginning of the experiment. The lambs of Lot 1 were livelier, more sportive, plumper, and showed far better development and growth than those of Lot 2.

The difference in the amount of water that was drunk as the experiment progressed was very marked. Lot 1 drank 61 pounds in 6 days; Lot 2, 21½ pounds. The solid voidings were of a very different character; those of Lot 1 being soft, while those of Lot 2 were hard and dry up to March 1, when the ration of mangolds was added.

It was evident by March 1 that Lot 2 would not become fat enough or have sufficient development, without some change in the ration, to compare with Lot 1; so a change of ration became imperative. The added root ration not only toned up the digestion of Lot 2, and enabled them to consume more corn meal than they could without it, and to make a gain of 2% more in one month than they had in the two previous months, but it also shows that Lot 1 was greatly benefited by the addition of roots to their food. Their average gain for the four preceding periods was 11¾%. The addition of the roots apparently increased it to 16%.

The average gain of Lot 2 for the same period was 7½%. The addition of the 4 pounds of roots increased this to 13%.

On the 25th of April the lambs were shorn and the wool of each lot weighed. The weight of the wool of Lot 1 was 55% greater than that of Lot 2; moreover, it was of a much finer texture and better quality than that of Lot 2.

The lambs were slaughtered on the morning of the 26th of April by an expert butcher. Each lamb was weighed, then slaughtered, then weighed again to determine the amount of blood in each lot. Then the skin, liver, kidneys, spleen, heart, and several other important internal organs were separately weighed, and finally the dressed weight was taken. The bodies were hung up to stiffen for one day, at the end of which time each one was carefully cut into four sections. All the sections were photographed, and an average set chosen, from which colored plates were made. These are admirably executed, and form a part of the bulletin.

The sections show well the comparative disposition of fat and lean meat on the lambs of both lots. Although the fat of each lot was not dissected out and weighed, it is quite evident from the cuts that the amount found on the lambs fed on nitrogenous food exceeded that produced by those fed on non-nitrogenous food. The lean was also increased to an equal or greater extent. Both these facts are shown especially well in the plates.

The live weight of Lot 1 was 21 per cent greater than that of Lot 2.

The metatarsal bones of Lot 1 were 22 per cent stronger than those of Lot 2.

The tibias of Lot 1 were 24 per cent stronger than those of Lot 2.

It is seen that the valuable parts are proportionately larger in those fed on nitrogenous food. The kidneys and spleen of the nitrogenous Lot 1 are also considerably larger, while all the other important internal organs are larger in those fed on non-nitrogenous food.

Although this experiment is but one of a series to be tried at the experiment station, and needs to be repeated many times before absolutely accurate results can be obtained, yet we may deduce from it that the effect of feeding an undue proportion of non-nitrogenous food to sheep is:

1. To decrease the production of wool by one quarter.

2. To decrease the strength of the bones by one third.

3. To reduce the production of both fat and lean meat.

Not one of these three important effects is desirable in sheep husbandry; hence we may conclude that corn alone is not the best food for sheep.

War Ship Charleston.

The launch of this new war ship was successfully effected at San Francisco on July 19. Over 20,000 spectators were present.

The Charleston is 320 feet long over all; length on load line, 300 feet; beam, 46 feet; draught forward, 17½ feet; aft, 19½ feet; mean draught, 18½ feet; and displacement, 3,730 tons. There are only two short stump masts, with military tops for machine guns. All the steel used in the construction of the hull and all for the engines (except the crank and two line shafts, which were made by Krupp at Essen) is of domestic manufacture, known as mild steel, made by the open hearth process. The beams, outside plating, and protective deck plates were made in the East by Carnegie, Phipps & Co. All the rivets, frames, and engine forgings, and all the steel castings, both for hull and engine, were made by the Pacific Rolling Mills Co., whose works are contiguous to the shipyards of the Union Iron Works. The stem, stern, and rudder pieces are single steel castings, the stem being ram shaped and specially strengthened by braces and other attachments to the steel protective deck. The sternpost was cast on June 22, 1887. There were 30,960 pounds of metal used, and the weight of the sternpost, when delivered complete to the Union Iron Works, was 11,130 pounds. The stem weighs 13,430 pounds, and the rudder frame weighs 9,420 pounds.

The plating of the Charleston is of rolled steel, the outside plating being from 7-16 to ½ inch thick, the inner bottom plating ¼ to 5-16 of an inch, and the sheer strakes ⅝ to ¾ inch. The horizontal plating of the protective deck, which extends from stem to stern, is 2 inches thick, and the sloping sides 3 inches thick. The motive power of the Charleston is furnished by two horizontal compound engines, which are placed in separate water tight compartments. The screws are three bladed, made of manganese bronze, and 14 feet in diameter. There are six main boilers and eighteen furnaces, with a total grate surface of 485 square feet, and 2,578 tubes, with a heating surface of 15,600 square feet. There is a bunker capacity of 800 tons of coal, but the normal draught is 328 tons. On a natural draught there is an indicated horse power of 5,000 horses, and on a forced draught of 7,650 horses, a maximum speed of 18·9 knots being thus attained. At an indicated horse power of 7,650, which requires the consumption of 800 tons of coal, the Charleston is expected to be able to steam 2,013 knots at the maximum speed. At the normal draught of 328 tons of coal, at the hourly consumption of 1·07 tons, and with 1,200 indicated horse power, she can steam 2,990·60 knots at 10 knots an hour; or with a forced draught of 800 tons of coal, 7,476·60 miles at the same speed.

The quarters of the officers and crew are all situated on the berth deck, as usual. Some improvements on the orignal plan, suggested by Naval Constructor Fernald, have greatly improved this deck. Farthest aft are the captain's staterooms, fitted in a sycamore veneering, dead polished, sliding doors, and furnished like the wardroom, which comes next. The steerage is much larger and more comfortable than in most ships. The galleys for officers and crew are situated in the center of the ship, inclosed in a steel bulkhead and specially ventilated, to carry off the odors of cooking. The sick bay and dispensary are placed in the bows, just abaft the paint room, divided from it by a steel bulkhead. The space on this deck from the sick bay to the midship bulkhead is the space where the 308 men who will compose the crew will sling their hammocks and mess. Wire lockers are provided here for the utensils of each mess. Head room on this deck is about 6½ feet, and the ventilation and light are as good as it is possible to make them, two blowers being used of 10,000 cubic feet capacity a minute. The cruiser will be lighted by two incandescent electric plants of 3,200 candle power each. All the most modern appliances for navigating have been provided. The masts are made of half-inch plate, and one of them is used for ventilating the dynamo room. The masts, rigging, and boats are being constructed at the Mare Island Navy Yard. As there is no projecting keel on the cruiser, two bilge keels have been provided to prevent rolling. These stand out 20 inches from the bilge, and are made of wood, plated.

Adverse criticism has been aroused by the failure to provide hydraulic gear for the heavy guns and the substitution of 8 inch for 10 inch rifles, which latter are carried on the Naniwa-Kan. The machinery has been superintended by Chief Engineer W. S. Smith, U. S. N., and Assistant Engineers E. T. Warburton and I. N. Hollis, U. S. N.

The keel plates of the Charleston were laid August 27, 1887, less than one year ago, and the first rivet driven September 1. Her hull weighs upward of 1,350 tons. It is thought that the cruiser will be ready to be turned over to the government in five months' time. By the contract she should be finished by June 28, and a penalty is fixed for delay in delivering her. Her contract price is $1,017,000; that of the English-built ship, the Naniwa-Kan, after which she was modeled, was $938,000 complete. The San Francisco will follow the Charleston on the stocks. Only one steel vessel had been launched from the Union Iron Works previously, the Arago, a 1,100 ton steamer, and the yard was not ready for the construction of a 4,000 ton ship. But when the contract for the Charleston was obtained, a large slip was run out 80 feet broad and 300 feet long, on a foundation of 70 foot piles, calculated to sustain a weight of 1,500 tons. Additional offices and shops were erected, a hydraulic dock completed, and a 100 ton shears constructed.

Curculio and Chinch Bugs.

Bulletin No. 4 of the Ohio Agricultural Experiment Station discusses some elaborate experiments in preventing curculio injury to cherries, and treats in a practical way the best midsummer remedies for the chinch bug, which has lately appeared in destructive numbers in Ohio. In the cherry experiment, which was conducted by the station entomologist, Clarence M. Weed, twenty-two thousand five hundred cherries were individually cut open and examined, and the conclusion reached that three-fourths of the cherries liable to injury by the curculio can be saved, without danger to the user, by spraying with a solution of London purple soon after the blossoms fall.—*Vick's Mag.*

The American Institute Fair, New York.

Large numbers of inventors and manufacturers have for many years found it of interest, and profitable as well, to attend and take part in the annual exhibitions of the American Institute, held in the fall of each year. The fifty-seventh annual exhibition will open October 3, at the hall of the Institute, on Third Avenue, New York City, and promises to be in no way behind any of its predecessors in attractive features. Intending exhibitors should make early application to secure good locations and the space needed.

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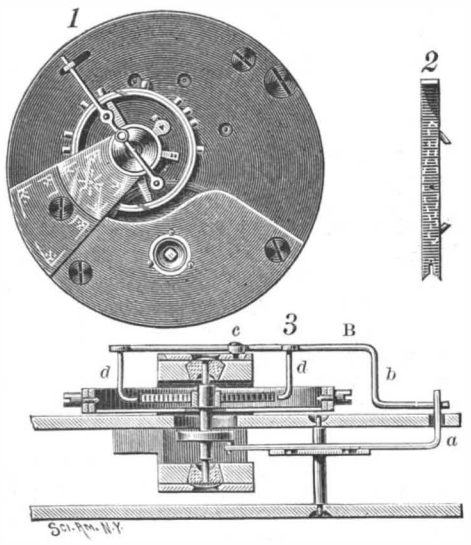
AN IMPROVED BALANCE ESCAPEMENT FOR WATCHES.

The application of a governor to the hair spring and balance wheel of a watch, in the form of a free curb actuated by the pallet or escapement lever, to lessen the effect upon the watch of jar or shock, is illustrated herewith, and has been patented by Mr. Sirus E. Kochenderfer, of Hollidaysburg, Pa. The escapement lever, shown in Fig. 2 (the escapement wheel not being shown), has a forked end in which works the pin on the balance staff roller, and the outer or back end of the



KOCHENDERFER'S BALANCE ESCAPEMENT FOR WATCHES.

lever is extended and bent to form a slotted arm, working through a slot in the top plate, as shown at *a*, in Fig. 3, this arm engaging with a bent arm, *b*, of a vibrating rod or wire, B, having its pivot, *c*, a little to one side of the axial line of the balance staff. This vibrating governor, B, has inwardly projecting curbs, *d d*, that serve to receive freely but moderately closely in between them the hair spring. This governor is vibrated in common with the escapement lever, by which it is driven, and serves to equalize the motion and adjust to equal motion in any position the watch may be turned. In case of shock or jar the balance wheel is restrained from making lost motion by the curbs of the governor, while the pin on the roller of the balance staff is not liable to work out of timely relation with the fork of the escapement lever, avoiding danger of locking the balance or producing breakage of the pin jewel.

THE AUTOMATIC RUBBER MIXER.

The accompanying illustrations represent a new appliance for the "compounding" of rubber which

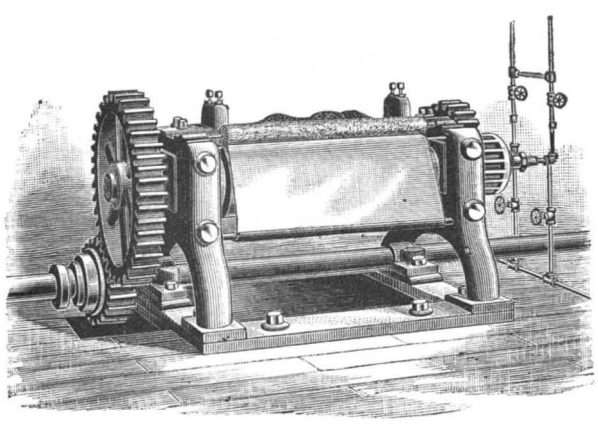


Fig. 1.—THE AUTOMATIC RUBBER MIXER.

promises much in the way of rapid and economical work. The automatic rubber mixer consists of a stout belt of duck covered with rubber, which runs horizontally beneath the mixing rolls, occupying the place usually filled by the "compound box." The upper surface of the belt when in use is drawn against the

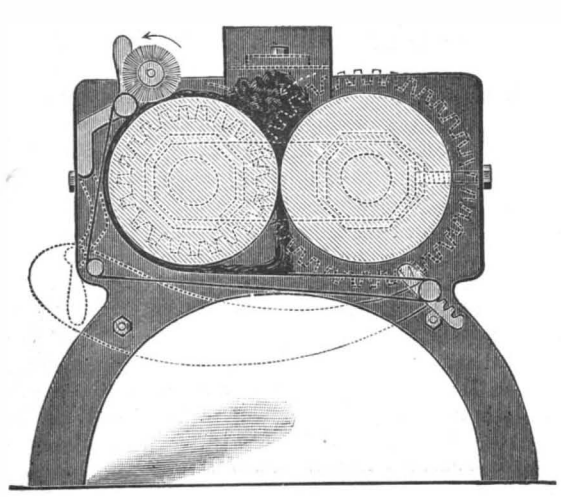


Fig. 2.—THE AUTOMATIC RUBBER MIXER.

face of the "back roll," as shown in black lines in Fig. 2, and is brought up even with its top, where it is held by two strong springs. The turning of the roll sets the belt in motion, which results in the constant and even feeding of anything that drops between the rolls, to the top, for further grinding. When a "batch" is thoroughly mixed the belt can be released and dropped out of the way, as shown in dotted lines, and the rubber refined with as much care as if no belt were there. If, during the mixing, the piece goes over the back roll, the belt springs immediately lengthen out, and the belt goes on with its work of carrying up the compound as easily as before. To prevent the working out of the compound between the ends of the rolls and its loss by dropping over the edge of the belt, a pair of metal guides are attached directly below the rolls, which serve to throw it in toward the center of the belt.

Practical tests with the automatic rubber mixer are said to show that one man can run three or more grinders with it, and deliver one-fourth more work from each. Aside from this, the product is far more homogeneous than when the compound is fed with a hand shovel, and there is less danger of burning sensitive stocks.

Fig. 1 is a perspective view of the mixer attached to a grinding mill, Fig. 2 showing an end view of the same, the belt being drawn up over the back roll and in the act of feeding the compound to the top of the rolls. Both American and foreign patents have been secured upon this invention and a company, known as the Automatic Rubber Mixer Company, No. 38 South Market Street, Boston, Mass., are now building the machines. Models of the mixer, as well as machines in actual use, may be seen, or any other information desired can be obtained by writing to Henry C. Pearson, general manager, at the above address.

Japanese Lacquer for Iron Ships.

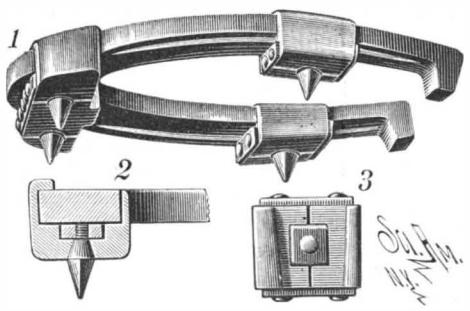
The Japanese Admiralty has finally decided upon coating the bottoms of all their ships with a material closely akin to the lacquer to which we are so much accustomed as a specialty of Japanese furniture work. Although the preparation differs somewhat from that commonly known as Japanese lacquer, the base of it is the same—viz., gum lac, as it is commonly termed. Experiments, which have been long continued by the imperial naval department have resulted in affording proof that the new coating material remains fully efficient for three years, and the report on the subject demonstrates that, although the first cost of the material is three times the amount of that hitherto employed, the number of dockings required will be reduced by its use to the proportion of one to six. A vessel of the Russian Pacific fleet has already been coated with the new preparation, which, the authorities say, completely withstands the fouling influences so common in tropical waters. It occupied the native inventor for many years to overcome the tendency of the lac to harden and crack, but having successfully accomplished this, the finely polished surface of the mixture resists in an almost perfect degree the liability of barnacles to adhere or weeds to grow, while presumably the same high polish must materially reduce the skin friction which is so important an element affecting the speed of iron ships. The dealers in gum lac express the fear lest the demand likely to follow on this novel application of it may rapidly exhaust existing sources of supply.

AN IMPROVED WIRE FENCE.

A wire fence in which the posts are braced and sustained in a novel way, and are laterally adjustable to accommodate the expansion and contraction of the wires, is illustrated herewith, and has been patented by Messrs. Thomas Griffin and William J. Mitchell, of Noblesville, Ind. Each post is anchored in place by a rod looped around a stone or other weight, and secured to the post by a nut, while upon the opposing face of the post is a rack having a central longitudinal aperture and aligning recess, adapted to receive a rack plate and lug secured to one end of a brace, as shown in the small figures, the lower end of the brace resting upon a stone or other suitable block. The brace is held in connection with the post by a lever pivoted to the post by a staple, a rod from one end of the lever extending through the brace, and having its end threaded to receive a nut, the tightening or loosening of which causes the post to incline slightly inward or outward, as may be desired, on account of the expansion or contraction of the wires. These post braces may be used in connection with as many of the intermediate posts as is found desirable, but are designed to be at all times employed in connection with the end posts. That the wires may be properly spaced, they are tied together by spaced vertical clamps or stays, consisting of metal bars pivoted one upon the other at their lower ends, as shown in a small figure, having slots at the desired distance apart, so arranged that when one bar is folded upon the other, the slots in each will register. This stay may be attached to all but the top wire, or may include that also, as shown in the illustration.

A REMOVABLE CALK FOR HORSESHOES.

A device whereby the calk may be securely held in place on a horseshoe, and readily removed therefrom for sharpening, is illustrated herewith, and has been patented by Mr. Thomas B. Mason, of 209 Warren Street, Trenton, N. J. A clamp is employed, shown in section in Fig. 2, having rocking portions connected together by straps and bolts, the toe clamp being formed with three rocking portions, the meeting edges of which are a slight distance apart, and have centrally beveled semicircular recesses, in which the calk is received. The

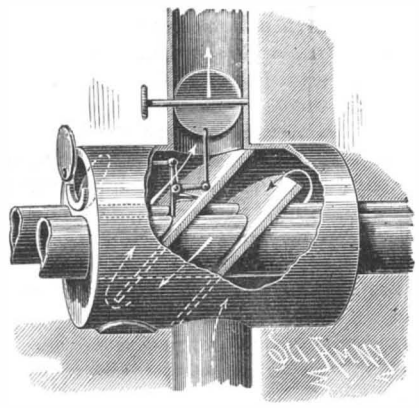


MASON'S REMOVABLE CALK FOR HORSESHOES.

calk has a shoulder which rests in these recesses, its inner end being screw-threaded, to engage a nut resting in an inside recess formed in the two adjacent rocking portions of the clamp, as shown in Fig. 3. As the calk is screwed into the nut, after the latter has been placed in its recess, the adjacent rocking portions of the clamp are forced apart, and cause the clips to be firmly pressed against the horseshoe. The clamps used in attaching the toe calks have a straight clip, which rests against the inner side of the horseshoe, with no projection to injure the horse's foot.

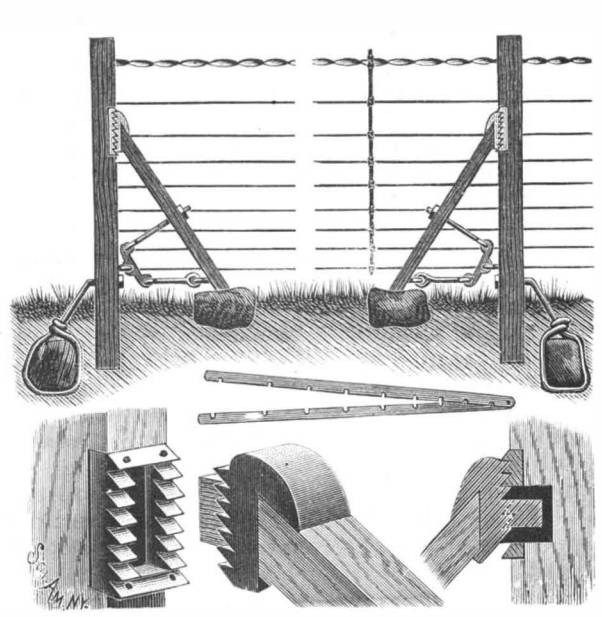
AN IMPROVED HEATING DRUM.

A drum for use in connection with stove pipes, either adjacent to the stove or distant therefrom, to retard the current of heated air in its passage to the chimney, and secure the best radiation of heat, is illustrated



GRAN'S HEATING DRUM.

herewith, and has been patented by Mr. Edward C. Gran, of Jordan, Minn. The heads of the drum have openings in which rest pipes through which the air of the room may freely circulate, the drum being secured to thimbles receiving the ends of sections of a stove pipe. The interior of the drum has inclined partitions, through which extend the lateral pipes, the partitions directing the current of heated air entering from the stove pipe in the lower opening of the drum, as shown by the arrows, around the lateral pipes, to the upper drum opening. There is an opening covered by a slide in the bottom of the drum, from which soot may be removed, and, in order to check the draught through the drum, it has an opening provided with a wire screen and pivoted cover, above the lateral pipes, this opening, which serves also as a ventilator for the room, being adapted to be closed on the inside by a valve connected with the damper. There is no opportunity for the drum



GRIFFIN & MITCHELL'S WIRE FENCE.

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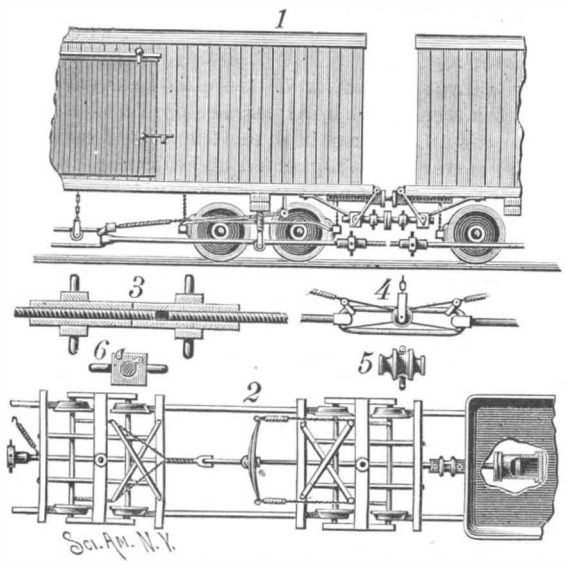
to become choked with soot, and thus rendered inoperative, and the construction is designed to afford a simple and effective means to utilize heat that would otherwise pass up the chimney.

AN IMPROVED AUTOMATIC CAR BRAKE.

A brake which is designed to be automatic, not affected by snow or ice, which adjusts itself to either direction in which the car is pulled, and which may be effectively operated when a train is moving at a high



TAYLOR'S CAR BRAKE.

rate of speed, has been patented by Mr. Frederick G. Taylor, of Cranston, R. I., and is illustrated herewith. A centrally hinged rod extends beneath the car from end to end, below the axles, supported by and reciprocating upon pulleys hung from the beams. The rods at the ends of the cars are threaded, and have couplings, as shown in Fig. 3, by which the several cars of a train are quickly united. A brake beam carrying brake shoes is suspended a proper distance in front of the wheels, and each end of one brake beam is connected to a lever fulcrumed to the extremity of a bar extended from the brake beam on the opposite side of the truck, the two levers crossing each other, and their free ends being each united to a spring secured to the bottom of the cars. A chain or rod is also connected to the free ends of the levers, the opposite end of the chain being secured to a spring fastened to a link in the center of the rod extending beneath the car. At each end of the car, below the drawhead, are brackets carrying fenders on their outer ends, the fenders being adapted to hold the cars at a given distance apart, whereby all strain is removed from the rods extending beneath the cars, allowing them to reciprocate freely at any time. These rods are reciprocated from the piston of a cylinder beneath the cab or tender, as shown in the plan view, Fig. 2, whereby the levers connected with the brake beams are drawn forward or back. Fig. 4 illustrates a construction whereby the brake shoes are put in operation on all the wheels simultaneously, no matter in which direction the brake rod is pulled.

AN IMPROVED SIGNALING DEVICE FOR MINES.

A reliable and inexpensive electro-magnetic signaling device, easily operated by any one of ordinary intelligence, and especially adapted for use in mines, is illustrated herewith, and has been patented by Messrs. Logan M. Bullitt and Oscar C. Greene. Fig. 1 represents the general arrangement of the conducting wires, batteries, and signal bell, Fig. 3 showing a side post by which the wires are supported, Figs. 4, 5, and 6 showing hand circuit closing devices, while Figs. 7 and 8 show a bell or sounder attached to a circuit closer. The bell or sounder actuated by the system is placed in proper position relative to the engine, near the mine entrance, and the incoming and outgoing electric current wires connected with it and the main battery, branch wires being employed for different chambers of the mine, extending from the main wires as required, so that the circuit is continuous to the signal bell along either of the main wires. The main wires and their branches are parallel with each other, and only a little distance apart, so that by connecting these adjacent wires anywhere along their length by a proper conductor the circuit will be closed and the signal bell sounded. Suitable hand instruments for so joining the wires and closing the circuit are shown in the small figures, Fig. 6 showing a circuit closer adapted especially to wires arranged one vertically over the other. The main battery may be made sufficiently powerful to supply the circuit on all the wires, or additional re-enforcing cups may be placed in the branch wire extension circuits, as shown in Fig. 1. This system of mine signaling has been for some time in practical use in mines of the Northern Pacific Coal Co., in Washington Territory, and is said to have given entire satisfaction. The apparatus is designed to be put up at a cost of not more than $50 per mile.

For further information relative to this invention address Mr. Logan M. Bullitt, No. 141 South Fourth Street, Philadelphia, Pa.

The New Cast Iron Guns.

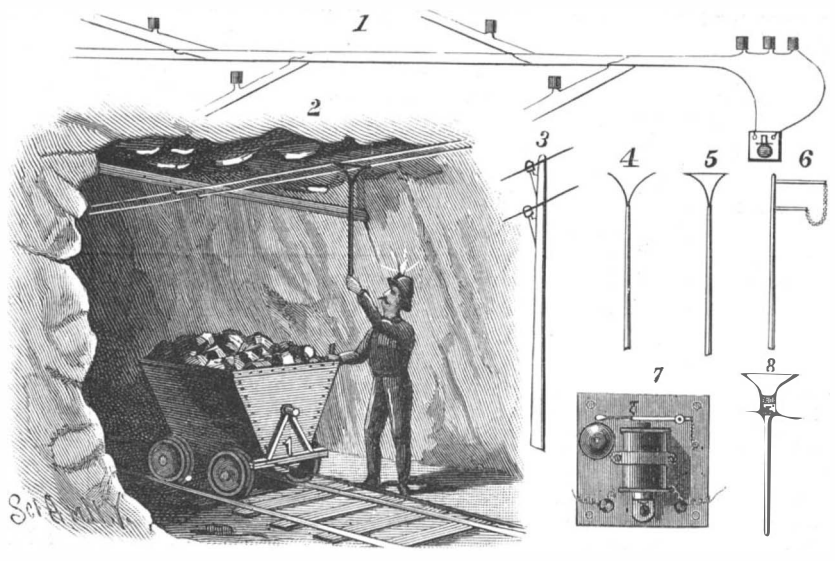
At the ordnance foundry of the South Boston Iron Works a large force of workmen is at present engaged in completing the third and last in the series of the three 12 in. cast iron rifled guns, with a steel tube and steel hoops. The work of putting in the steel tube, which is inserted at the rear of the barrel, extending through from the breech, has just been completed, after three trials, to insure getting a perfectly tight joint at the shoulder or casing of the gun. The gun was placed horizontally over a longitudinal pit, and was then covered in with boiler and sheet iron. A fire was built under it, extending from the breech of the gun to a point in front of the trunnions. The body of the gun was expanded by the heat, and the steel tube was inserted from the rear. A stream of cold water was kept circulating through the bore of the tube, to keep it cool, during the whole operation, which lasted about twenty-one hours. The gun was then cooled down at the breech to make it grip the tube, so that in contracting the front end of the tube was brought to a tight joint against the forward shoulders in the casing or body of the gun. An ingenious arrangement of bolts and set screws, together with a 100 ton jack, was used in inserting the tube and holding it in place until the cooling was completed. The gun will be transferred to the lathe in a few days to be finished, bored, and rifled, and will be delivered to the government early in the fall.

Artesian Wells in Sonoma.

A few weeks ago, according to the *Weekly Bulletin*, "a fine flow of excellent water was struck at a depth of ninety feet, on a lot a little to the east of the town of Sonoma, belonging to Mr. Gilbert. The next attempt was made at Mr. Winkle's vineyard, when at a depth of eighty-two feet a flow of 90,000 gallons per day was obtained. The tools were then moved about 150 feet south to the lands of J. Gundlach, where still greater success was met with. At a depth of one hundred and ten feet a flow of 100,000 gallons per day was reached. Both these wells are located in the foot hills, considerably above the level of the valley and supposedly in a very unlikely place to find such a result. The tools penetrated successive layers of sand, rock, and clay, the water being found below the latter. The water comes out with considerable force, and will overflow a pipe twenty feet above the surface. The fortunate owners of these wells consider them worth not less than $10,000 apiece. The temperature of the water is constantly 72° F., and what is remarkable is that it is exactly the same as that of several springs on the other side of the valley, four or five miles away. Many of the farmers and fruit growers of the valley are arranging to put down wells."

Australian Mice.

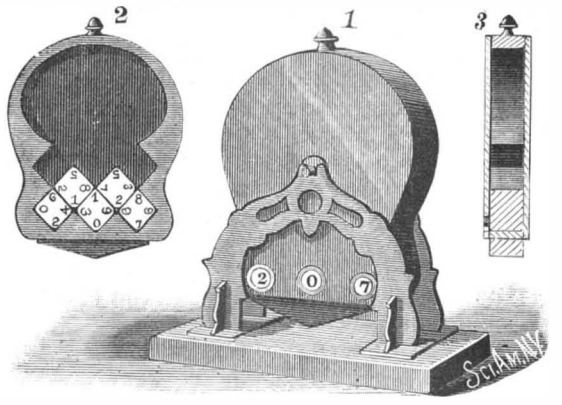
The mouse pest in Australia is much worse than the rabbit pest. The climate is so soft that they have thrived enormously, and there is said to be "hardly a residence or store that is not pestered by the plague. In some places they are so thick that, in order to get the stock properly fed, men have to watch while they are eating their provender. The week before the Coolah races the vermin got into the boxes at the station, and actually ate the bandages off the horses' legs, while from every side come tales of crops devoured so rapidly that many fields have had to be abandoned, what was left not being worth reaping."



BULLITT'S ELECTRO-MAGNETIC SIGNALING DEVICE FOR MINES.

AN IMPROVED DIE AND DICE BOX.

A closed dice box, mounted to be revolved on journals, the closed box having a chamber just the width of the dice, with recesses where the dice come to rest, so that the numbers on their sides may be read through holes in the sides of the box, is illustrated herewith, and has been patented by Mr. Reinhold F. De Grain, of No. 657 Pennsylvania Avenue, S. E., Washington, D. C. The central chamber is just enough wider than the dice to permit them to tumble freely without changing their planes, the bottom recesses being angular to correspond with the angles of the dice, as shown in the interior view, Fig. 2, the side recesses being designed to cause the dice to turn in tumbling, to show different faces. The box has a knob or thumb piece at the top, for convenience in revolving it, and a



DE GRAIN'S DIE AND DICE BOX.

weight fixed to the bottom to cause it always to gravitate to the proper position.

How Scarlet Fever Poison is Distributed.

Dr. J. Brooke, Surgeon U. S. Army, of Fort Monroe, Va., communicates the following case: "A girl aged about eight, living at this place, was some months ago attacked by scarlet fever, the disease running a typical course. For a long time no possible source of contagion could be discovered. The child had not been absent from home, had been with no one lately exposed, and no other case was known to exist anywhere in the vicinity. Subsequently I learned that one of the house servants had nursed a case of scarlet fever in a distant city just about a year before. After the case terminated she packed some of her things, including some clothing then worn, in a trunk, and left the place. A year later she had the trunk sent to her here, opened it, and took out the contents, the little girl being present and handling the things. Very soon after the latter was attacked, as stated."—*Medical Record.*

Biting the Finger Nails.

Dr. Jerome Tuthill, of Chicago, Ill., in the *Medical Record*, says: A novel accident, resulting from a habit of very common prevalence among nervous people, was brought to my notice recently. A young lady presented herself at my office complaining of a constant irritation in her throat. Two weeks previously she had been taken with a severe "sore throat," which was treated by a neighboring physician. Under his care, she says, the inflammation quickly subsided, but there still remained a sensation of irritation. Examination revealed a small fleshy-looking object, about the size of a kernel of wheat, adherent to the tissues posterior to the left tonsil, by one end. The other parts of the throat were normal. The little mass could not be detached by a cotton-covered probe, but by the use of forceps it was easily removed, and on examination proved to be a piece of finger nail, which had become covered by a cheesy deposit. A broken piece of the nail was also removed from under the mucous membrane at the same spot by a sharp-pointed probe. The patient then confessed to the habit of biting her finger nails, and, moreover, could remember that a day or two previous to the onset of her throat trouble a piece of nail which she had bitten off had become lost in her mouth, but after it had caused a fit of coughing she had forgotten about it until reminded by my discovery.

A GIGANTIC FOSSIL.—Professor F. W. Cragin, of Washburn College, recently discovered at Downs, Osborne County, Kansas, the petrified remains of a huge fossil. Professor Cragin pronounces it the most remarkable specimen found since 1877. The animal complete was a little over 16 feet in length. The jaws measure 3 feet 8 inches, the neck between 4 and 5 feet long, and the body about 9 feet long, and 3 or 4 feet through. It had immense teeth, about 3 inches in length. It had flippers quite similar to a seal's, and its feet, two in number, were short. It is plain that it was an aquatic animal of the reptilian age.

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Manufacture of Gas.

A reporter of the Hartford *Courant* gives in that journal the following description of the manufacture of gas in Hartford, Conn. :

It is such a simple, easy, and altogether natural thing to strike a match and light the gas, that nobody stops to think how the gas got there until the bill comes in, and then only in the abstract. Some of the consumers may feel at that time that they are putting their hands pretty far down into their pockets, but they do not reflect upon the amount of money that somebody has to pay out every day to furnish them with an article so indispensable to their comfort. To extract gas from coal is by no means a complicated operation, but to do this, rid it of its many undesirable constituents, and make it fit for illuminating purposes, is a matter much more difficult of accomplishment.

To begin with, gas is made by a roasting process in highly heated retorts. These retorts, made of fire clay, are D shaped, are 9 feet long, 15 inches high, and 26 inches wide. They are put in arches, six to the arch, which, in gas works phraseology, are called benches. Each bench is heated by one fire. Into each retort, according to the style of the bench and the furnace for heating the same, is put once in 4 hours from 225 to 325 pounds of coal. The heat from the furnaces applied to the retorts roasts the coals and drives from it its various products in a gaseous form, leaving in the retorts a coke, about 30 per cent of which is again used in the furnaces for supplying the heat necessary for carbonizing the coal, and for other purposes about the works where heat is desirable. The remainder is disposed of for manufacturing and domestic purposes, not only in Hartford, but in all the surrounding country as well. After the gas is generated from the coal in the retorts, it passes through the ascension and dip pipes, so called, one of which connects with each retort, and into a large pipe, known as the hydraulic main, and placed on top of the benches. This main is partially filled with deposits of coal tar, a product of the coal, and water, the latter being supplied to form a seal over the mouth of the dip pipe, thus preventing the gas from coming back through the ascension pipe and keeping the air from passing in at charging time. A fallacy exists in the minds of some to the effect that air is purposely forced in, so as to increase the pressure, whereas the contrary is seen to be the fact. From this point the gas is conveyed through a large pipe to the exhausters, which is a kind of reversed blower used to force the gas from this point through the different apparatus in use, and finally to propel it to the huge holders in which it is stored ready for distribution. The next step in the process is to pass the gas through an apparatus called the multitubular condenser, which consists of a series of pipes immersed in water, the object being to lower the temperature of the gas. From the condenser the current passes to the scrubber, a machine made in the form of a hollow chest with a number of trays, upon which is laid a quantity of small branches of white birch. The twigs serve to break the globules of gas, in the same manner that a soap bubble might be punctured, and from the top water, dripping down in a continual spray, comes into contact with the gas and extracts from it the ammonia, for which it has a remarkable affinity. The temperature of the gas becomes greatly reduced by this time, and tar separates from it and is collected in boxes at the bottom, and, by a series of pipes, conducted to the tar wells.

Until about a year ago the apparatus just described was thought sufficient to accomplish the purpose, but the company, ever on the lookout for improvements, has recently adopted additional machinery for ridding the gas of tar and ammonia. One of these, a "Walker tar extractor," a rather complicated piece of apparatus, effectually removes every particle of tar that escapes the clutches of the scrubber. The ammonia is wholly removed by the next piece of apparatus with which the gas comes into contact, which is called the standard washer scrubber. It consists of a number of wheels composed of thin sheets of iron, which continually revolve in water. When rising above the water line these disks present a large wetted surface to the gas, abstracting from it all the ammonia it contains. Following the process to the next step one comes to the purifying house, where are placed four purifying boxes, each 20 × 24 feet and 4 feet deep, through three of which the gas passes successively. Inside of each is a series of trays covered with carefully prepared lime, designed to remove from the gas all traces of sulphur. Passing on, the gas goes to the large station meter, where it is all measured as made, and then conveyed to the various holders, where it is stored ready for use. The holder floats in a reservoir filled with water and gradually sinks lower and lower into the water as the gas is drawn out. When full, the holders stand almost entirely out of water.

The quality or illuminating power of the gas is tested in the photometer room, in which is placed a complete and expensive apparatus. The walls of the room are painted a dead black and daylight is totally excluded, so that the tests, which are made every day, are as accurate as it is possible to make them. The reader who has followed the process thus far will readily understand that the manufacture of gas involves a good deal of labor and necessitatesconsiderable costly machinery.

In an upper room is the place where meters, both new and old, are tested. Here are to be seen spick span meters in the flush of youth, beautifully painted and decorated, waiting impatiently to start out on their career of usefulness. They have been weighed, as it were, and found not to be wanting, and upon their clock-like faces is an expression that inspires confidence. Close at hand is a row of meters that have come under suspicion, and they stand there like guilty things waiting to give an account of themselves. In a corner is a pile of worn-out, cast-off meters, so hardened that they would not tell the truth if they could. Now, like dead men, they tell no tales.

The gauge, where the meters are tested, is a very accurate instrument, and does its appointed task without the possibility of a mistake. Hence, if consumers know that their meters are reliable from having had them tested at the works, they may rest assured that they are paying only for what they use. Your milkman, unintentionally perhaps, holds the measure tilted a trifle on one side, and you get a tablespoonful or two less than your quart every day; the dry goods clerk, in measuring off a yard of cotton cloth, not infrequently forgets to make allowance for the portion covered by his thumbs; your butcher—thoughtless man that he is!—throws a sheet of heavy wrapping paper upon the scales before weighing your meat, and so the list might be prolonged indefinitely. With the meter, however, it is *quid pro quo*, always provided, of course, that its moral sense has been preserved intact through all its years of service at your house. The company is always willing to test a meter whenever its honesty is doubted. The company has inaugurated a system of having all the meters in the city tested once in three years, which is done at its own expense and without annoyance to the consumer.

In addition to maketing the coke and coal tar for all sorts of uses, the company has recently been able to put the ammoniacal liquor into such a shape that it could be shipped. Formerly this liquor was permitted to escape into the Little River, and it is a fact worth noticing that the stream below Front Street was for 40 years entirely cleansed of the impurities which are so offensive to people living in the vicinity of Ford Street and along the rest of the river front. The authorities will soon have to provide for the proper treatment of the stream below Front Street, and, indeed, they have already contracted for the erection of a retaining wall there. The ammonia is shipped in large quantities to Syracuse, N. Y., where it is used for manufacturing purposes. It is chiefly by means of selling these various products that the company has been able to reduce the price of gas from $3 per thousand feet, which was the rate ten years ago, to the very low price at which it is now sold.

To keep up with the progress of the age and to make the gas yet cheaper, the company, finding that the old retort house, containing 16 benches, was practically worn out and of little use from an economical point of view, decided some time ago upon a new building. It has therefore caused to be erected a building about 100×68 feet with walls 16 inches thick and 32 feet high, covered with an iron roof frame and slate laid in cement. The building, which is two stories high, contains a stack of nine benches, with regenerative furnaces on the Stedman-Stanley principle. The size of the benches and furnaces, being largely in excess of the common ones in use, will greatly increase their productive power at a largely reduced cost for fuel. It will probably effect some saving in labor besides very largely increasing the comfort of the men employed. The benches are on the north side, the rear of the stack being within four feet of the wall. In this space is laid the main flue, through which the escaping gas from the furnace is conveyed to the large chimney, which is 150 feet high. On the south side have been laid the foundations for a corresponding stack of benches should they be needed in the future. Between the two is ample space for charging the furnaces. The cellar is ten feet high, and the floor above is of heavy cast iron plates laid on girders and supported by cast iron pillars. Coal will be raised to the charging floor by an elevator and put into the retorts. The coke when drawn from the retorts will be dropped through trap doors into the furnace below as needed or else conveyed to market, saving largely in the cost of handling.

The new retort house, as well as all of the improvements, were planned by Mr. John P. Harbison, the treasurer and general manager of the company, and its construction, even to the minutest detail, has been under his personal direction and supervision. Mr. Harbison, who was originally engaged at the works for a period of two weeks only, has been connected with the company since boyhood, and has conducted the affairs intrusted to him with remarkable sagacity and business foresight. He was recently elected an active member of the British Gas Institute, the largest and most influential organization of gas engineers in the old world.

The Mechanism of Zymotic Diseases.

The most recent advances in biological research afford a basis on which to erect a more or less plausible theory of the mechanism of diseases caused by micro-organisms.

The domain of parasitism is far wider than has hitherto been accepted. The principles of evolution teach us life is one ; living forms being but strands in a complicated web, no single fiber of which can assert its independent genesis and history from any other fiber, however remote, while each of these forms possesses a greater or less antagonism to other forms. So it would appear a large proportion of the maladies, whether in plant, fish, reptile, or mammal, are produced by parasitism—the antagonism of lives—the lesser lives feeding on the greater. The higher animal organisms are but communities of living points, some floating free, others stationary—these last attached to their neighbors by protoplastic bonds of marvelous tenuity, just as adjoining households may have telephonic connection, but with their individuality and their automatism unimpaired. A colony of inimical microbes obtaining access to this republic is similar to a hostile armed band entering a city—strife at once commences, the strangers attack and are attacked. If the strangers are all killed, no disturbance of health is produced. In any other event, the strangers increase and multiply at the expense of the normal inhabitants, the latter being rather destroyed by some special soluble toxic substance excreted by the enemy than in any other way.

Each micro-organism seems to have a particular rate of multiplication, and when a sufficient quantity of toxic material has accumulated, then the phenomena of fever and eruptions are produced. So far as experimental research has gone, there is no true incubation; there is no mysterious localization of the invading band in lymphatic gland or vessel for days or weeks. The battle at once commences, but it is only when a certain number of the strangers have got the upper hand that a sufficient disturbance of function is produced to give external sign.

In the case of the individual little mass of bioplasm, a few hours may represent several generations, so that acquired properties are very rapidly transmitted; those poisoned by the excretion of the pathogenic microbes perish, those that more or less effectually resist continue to live and propagate, until, by a repetition again and again of this process, the body may be full of resistant living particles. In that case the foreign tribe is conquered, destroyed, expelled, and what is called recovery takes place.

If now a second colony gain access to the same animal tissue, it meets with descendants of the old heroes, and the attack is immediately repulsed. This is the nature of protection from a first attack.

Vaccination is but a modification of the same process. Colonies composed of the weaker members of some malignant tribe enter the citadel, a brief struggle ensues, the inhabitants finally destroy them, and the education thus acquired renders the inhabitants able to cope with a second stronger colony. This second successful fight renders the survivors and their descendants still hardier, and so the process may be repeated until they are able to easily resist the strongest and most virulent of their assailants. This is the phenomena of protection by inoculation of attenuated cultures.

Lastly, it would seem from the experiments of M. Roux and others that the living points of the animal organism may be educated in resistance by being dosed with the excretory products of pathogenic organisms, and that the inoculation of attenuated organisms is not necessary. If this is so, it would in no way alter the conception of the mechanism of immunity; that is, it essentially depends on the production of a sufficient number of resistant masses of bioplasm, this resistance having been acquired by inheritance from ancestors who have made successful combats against a particular microbe, just as the descendants of Dr. Dallinger's saprophytes were ultimately able to live at a temperature of 158° F.—*Public Health.*

Great Guns.

In a recent debate on the army appropriation bill in the House of Representatives, Mr. Wheeler said : "I am unalterably opposed to a large army, and I do not know a better way to prevent the necessity for an augmentation of our military force—so important to be avoided—than to keep up with the world on the question of material armament. A gun does not eat rations, wear clothes, or draw pay, but it is always on hand for duty, and can easily be moved to the place where it is most needed. There are now mounted upon vessels of foreign navies 129 guns which throw a projectile 10 miles and upward, and the caliber of these guns varies from 12 inches to 17 inches, and they throw projectiles which weigh as high as 2,000 pounds. It also appears that there are now afloat in foreign navies 66 guns which throw projectiles weighing from 900 to 1,250 pounds a distance of at least 9 miles." It is to be regretted Mr. Wheeler did not mention some of the ships that throw projectiles as he states. We fear it will be difficult to find the vessels.

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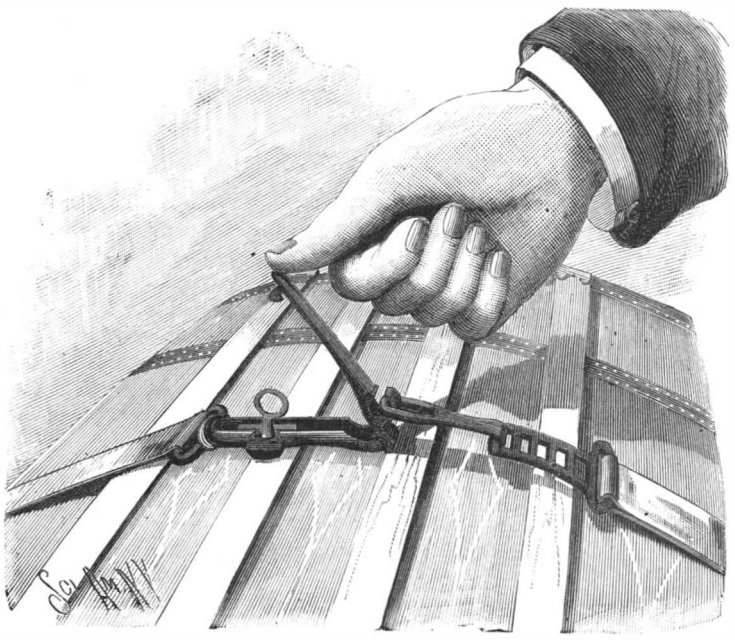
AN IMPROVED TRUNK STRAP COUPLING.

A simple and effective coupling for connecting the ends of a strap for tightening it around a trunk, box, or package, is illustrated herewith, and has been patented by Mr. Henry B. Lum, of Red Bank, N. J. The main or lock plate of the coupling has at one end a buckle or loop, for engagement with one end of the strap, the under side of the plate being recessed to receive a bolt projected by a spring, and which may be operated by a key to release a hook formed on the free end of a straining lever, pivoted at its other end to the outer end of the plate. A metal retaining ring is also adapted to be caught under the flanges of the lock plate to hold the straining lever in locked position. The straining lever is also provided at each side, toward its back or pivoted end, with a flange or lip, which overhangs the body of the lever sufficiently to engage inbent lugs on a catch plate buckle of the coupling, the outer end of the catch plate being formed with a loop for engagement with the other end of the trunk strap, whereby the two end parts of the strap may be drawn together to tighten it on the trunk or box to which it is applied. It is not essential that the catch plate buckle be used to fasten the strap around a trunk, as one end of the strap may have a hole through which the straining lever may be slipped prior to drawing down the coupling. The trunk strap to be used with this coupling may be of leather, metal, or other suitable material, annealed corset steel answering admirably therefor. The coupling is made in connection with such a metallic strap, about 1¼ inches wide, which can be rolled up to take less room than an ordinary leather strap, affording a powerful lock and at the same time an adequate support to sustain the heaviest trunk against breakage, and the manufactured strap is sold by Mr. W. H. Parker, Jr., of No. 149 Broadway, New York City.



LUM'S TRUNK STRAP COUPLING.

A Railway Catechism.

How many miles of railway in the United States? One hundred and fifty thousand six hundred miles—about half the mileage of the world. How much have they cost? Nine billion dollars. How many people are employed by them? More than a million. How long does a steel rail last with average wear? About eighteen years. What is the cost of a palace sleeping car? About $15,000, or $17,000 if "vestibuled." What is the cost of a high-class eight-wheel passenger locomotive? About $8,500. What is the longest American railway tunnel? Hoosac Tunnel, on the Fitchburg Railway (4¾ miles). What is the highest railroad in the United States? Denver and Rio Grande, Marshall Pass, 10,852 feet. What is the highest railroad bridge in the United States? Kinzua Viaduct, on the Erie road, 305 feet high. What is the longest railway bridge span in the United States? Cantilever span in Poughkeepsie Bridge, 548 feet. What is the longest mileage operated by a single system? Atchison, Topeka and Santa Fe system, about 8,000 miles. What line of railway extends furthest East and West? Canadian Pacific Railway, running from Quebec to the Pacific Ocean. What road carries the largest number of passengers? Manhattan Elevated Railroad, New York, 525,000 a day, or 191,625,000 yearly. What is the fastest time made by a train? Ninety-two miles in ninety-three minutes, one mile being made in forty-six seconds, on the Philadelphia and Reading Railroad. What is the fastest time made between Jersey City and San Francisco? Three days seven hours thirty-nine minutes and sixteen seconds—special theatrical train, 1886. What are the chances of fatal accident in railway travel? One killed in 10,000,000. Statistics show more are killed by falling out of windows than in railway accidents.—*Frank Leslie's.*

The Agassiz Seaside Assembly.

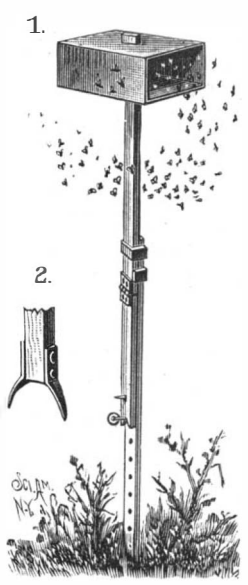
During the past week, from August 6 to 11, the Agassiz Seaside Assembly has held its sessions at Asbury Park, N. J. The general work of each day included an excursion—botanical, microscopical, or entomological—in the morning, followed by conversaziones and lectures in the afternoon. Educational Hall was used as the place of assembly, and audiences of good numbers greeted the various speakers. The opening lecture, on Monday, was delivered by Prof. Harlan H. Ballard, of Pittsfield, Mass., president of the Agassiz Association. He spoke of the objects and aims of the association and told how to establish a chapter. On the succeeding day Rev. L. H. Lighthipe read a paper on the "Flowers of New Jersey." On Wednesday Prof. F. C. Van Dyck, of Rutgers College, held a conversazione on the use of the microscope. On Thursday Rev. G. D. Hulst, State Entomologist of New Jersey, was the lecturer, and on Friday Dr. T. O'Conor Sloane lectured on "How to Make Scientific Experiments with Simple Apparatus." On Saturday, after a highly successful session, the meeting adjourned.

Carbolate of Camphor.

A new compound is mentioned in the *Therapeutic Gazette* to which is given the name of carbolate of camphor, and which appears to possess the antiseptic properties of carbolic acid, and the carminative properties of camphor, without the cauterizing properties of the former. It is prepared by dissolving camphor in a 95 per cent solution of carbolic acid to saturation. The carbolic acid will dissolve about three times its weight of camphor, and the product is a thin, clear, oleaginous mixture, having a strong odor of camphor, and a very faint odor of carbolic acid. To the taste it has a strong, and, at first, slightly pungent flavor of camphor, but no flavor of the acid. It dissolves readily in vegetable oils and in vaseline, mixes with sulphuric ether, dissolves salicylic acid, cocaine, iodoform, and, in the proportion of forty grains to one ounce, disguises the odor of the latter. Taken internally, in ten drop doses administered in capsules, it produces a sensation of warmth in the stomach which is not unpleasant, and which continues for an hour or two. When applied to the skin it produces a slightly warm sensation for a few moments, and when applied to an abraded surface it smarts for a moment and then all pain ceases. Injected hypodermically it causes stinging, quickly followed by anæsthesia. When mixed with an equal quantity of cotton seed oil, and applied to a fresh wound on gauze or cotton, and kept well covered, no suppuration follows, nor does vesication or pain.—*American Druggist.*

AN IMPROVED DEVICE FOR HIVING BEES.

A practical and inexpensive device whereby bees that swarm on the limbs of trees, or in other high places, may be conveniently hived, is illustrated herewith, and has been patented by Mr. William J. Daniel, of Jeffersonville, Ky. It is constructed with a standard having points on its lower end to take a firm hold on the ground, as shown in Fig. 2, and a guide loop near its upper end for holding a sliding box or hive supporting section. The sliding section has a loop to clasp the standard, and at its lower end has a hinged extension piece, which serves as a handle for sliding the upper section, this extension piece having a sharp pin to strike into the upper section for holding the piece in folded position. The sliding section is held at any desired place by inserting a pin beneath it in holes provided therefor in the standard.



DANIEL'S DEVICE FOR HIVING BEES.

THE total eclipse of the moon, on the night of July 22, was very generally studied by the astronomers connected with our colleges. At Amherst many photographs of the total eclipse and other phases were obtained with the large telescope. Professor Todd found that scores of faint stars were occultated by the moon during the progress of the eclipse, and that the illumination of the moon's surface during totality was much less than usual. It was irregularly illuminated, except near the time of central. The eclipse, when in the middle, was a large dark area, surrounded by a nearly perfect ring of light. At no time did the moon disappear from view, as it did during the eclipse of 1761, when no part could be seen, either with or without a telescope. The copper color was visible, but not so intense as ordinarily.

A Hypnotized Man Turning Robber.

May one who is free from vicious tendencies be made to commit a crime, while hypnotized, which he or she, with full command of faculties, would regard with abhorrence? Experiments both here and abroad have abundantly illustrated the wonderful power possessed by the operator over his subject; the latter wholly subordinating his will: acting, speaking, and, to all appearance, even thinking and seeing as directed. A recent investigator, M. W. A. Croffut, would seem to have gone a step further on the road to practical accomplishment by inducing his subject to actually rob a house; a pre-arrangement, of course, the agent, however, having no knowledge of this. This agent, whom Mr. Croffut describes, in a recent paper, as of known probity, set out, while in a hypnotic state, to rob a neighboring house, which, together with the means of entrance, was fully described to him; being told that a heap of gold was to be found in a certain apartment. The operator's assistant accompanying him declares that, after gathering up the imaginary treasure and putting it in the bag provided him, the subject proceeded to purloin other articles, so thoroughly aroused was his cupidity, and getting safely out evinced an inclination to fly with the treasure instead of returning and dividing with the operator, as was agreed. Another subject, under similar influence, took a pistol, supposed to be but not really loaded, and, aiming it at his heart, as directed, pulled the trigger. If from these and similar investigations it should become apparent that all manner of real crimes may be committed by innocent persons while in this hypnotic or mesmeric condition, and if the vicious, having such power as that evidently possessed by Mr. Croffut and others, should actually employ the unsuspecting and unsuspected as their agents, how would society protect itself? How could the innocent agents be distinguished from those not under such influence, but setting up the claim when caught only to avoid punishment? A really honest clerk, with the keys of his employer's office and safe in his possession, might be made, should he fall under such influence, to commit a burglary; the heir to an estate might be induced to kill himself; a trustworthy servant to commit murder or arson.

These are interesting psychological questions; questions, it may be said, which are by no means beneath the dignity of science to inquire into.

Prospects for Sugar on the Pacific.

The whole of the Pacific States and Territories can, no doubt, produce six to seven million tons, enough to supply 50 per cent more than the present consumption of all civilized countries. That consumption, though, is increasing very rapidly, and it doubles in the United States in about twenty years. Thus in that time it would absorb all the possible production of the State. The value of 3,110,000 tons of sugar would, at 5 cents per pound, be close on three hundred and fifty million dollars per annum. To obtain it one has to go abroad. Besides the return to the farmer, the industry gives steady employment at the rate of about one man to every 30,000 pounds of sugar.

The total product of all the sugar lands in California would, therefore, give work to not less than 230,000 men, representing a population of 1,600,000, including traders, manufacturers, wives, children, etc. It would, besides, give support to a great and varied industry. It would need 21,000,000 barrels to contain the sugar, and thus give support to a vast cooperage industry and lumber interest. The engines would consume 19 barrels of oil to each ton, or 58,000,000 barrels to the total possible production of the State. This would, no doubt, exhaust all the crude oil that California can produce. The use of two per cent slake lime would call for over 400,000 barrels of lime a year. The machinery needed, too, in these mills would cost $48,000,000, and would require renewing say every fifteen years, thus creating a foundry business of over $3,000,000 a year. An immense quantity of coal would be consumed, so that it would give support to a great mining interest. And we have not yet nigh exhausted the list of all the new industries that this great one would support. We have delineated its possibilities. It would, of course, take a long series of years to arrive at the results here presented. That it is possible under any circumstances may be known from the fact that the last sugar made cost 4 84 cents per pound, and that it is stated on good authority it can be laid down in San Francisco for 3½ cents per pound, so that California can easily hold her own in beet sugar production.—*San Francisco Journal.*

PROFESSOR REVERDIN gives the following formula of an antiseptic soap that is quite soft to the hands, cleansing and disinfecting them without causing any irritation:

Sweet almond oil	72 parts.
Soda lye	24 "
Potash lye	12 "
Sulphocarbolate of zinc	2 "
Essence of rose	9 "

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COMBINED TRACTION ENGINE AND CRANE.

Our engraving shows a combined traction engine and crane constructed by Aveling & Porter, of Rochester, England.

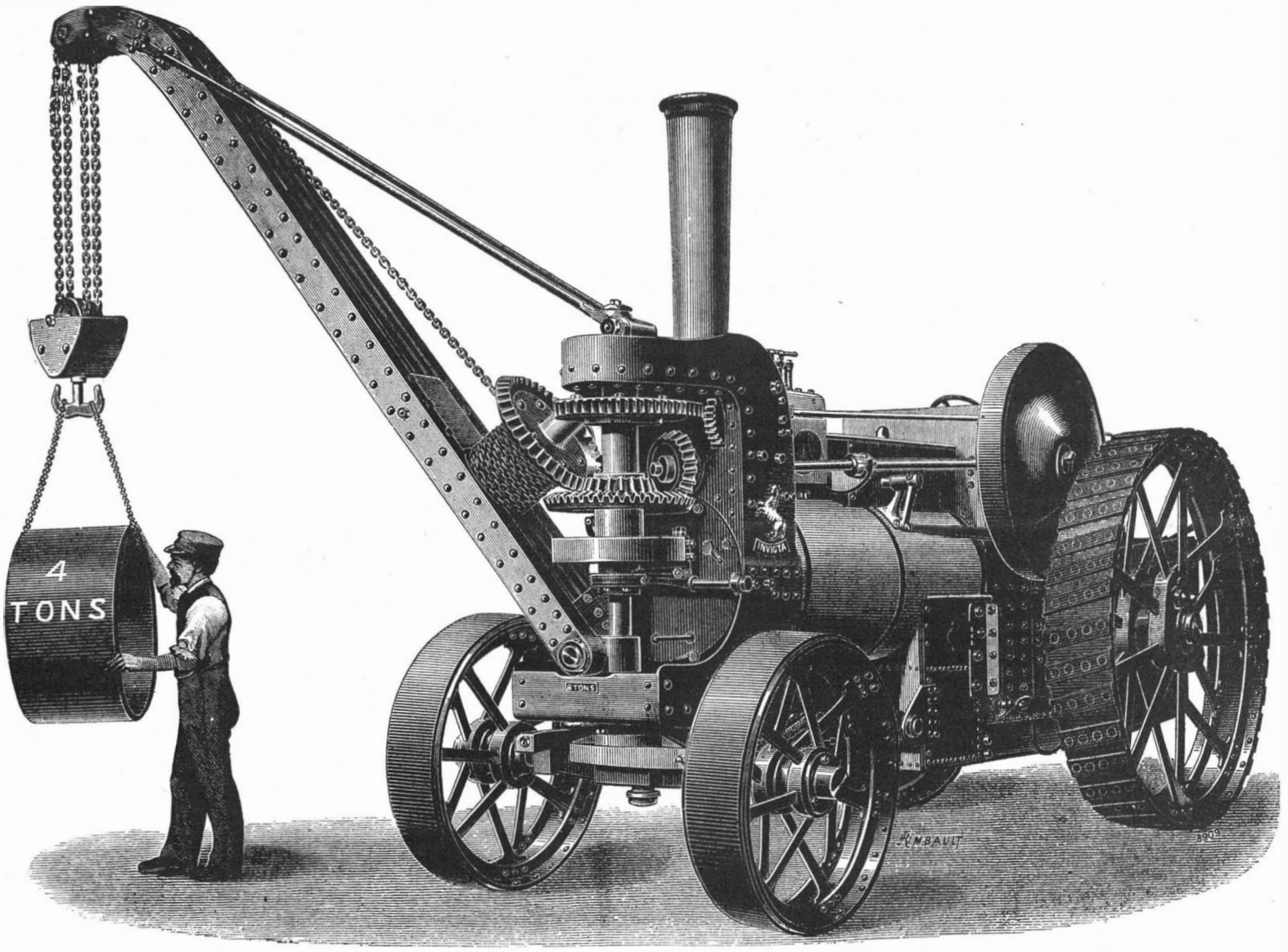
The jib swings on a crane post or shaft standing in front of the smokebox, this post being carried by a wrought iron plate framing of neat design. The chain barrel is mounted on the jib itself, and carries a bevel wheel which gears into a pinion cast on a sleeve which is mounted on the crane post. This sleeve has also cast on it a drum disk, which lies between the driving disk and the brake disk, this latter disk being fixed on the crane post. By means of taper clutch blocks actuated by the levers, the drum disk can be clamped to either the driving or the brake disk, and the load thus be raised, held, or lowered.

The driving disk is in one with a bevel wheel which gears into a bevel pinion on a diagonal shaft running along the left hand side of the engine. This shaft is kept continually running while the crane is in use.

The slewing is effected by a worm gearing into a segment on the crane post. The spindle of the worm carries a wormwheel into which gears a pinion, running on a stud, and receiving its motion from the diagonal shaft through the friction clutches. There are mounted on the diagonal shaft two bevel pinions (both gearing into the pinion on the stud), these pinions running loose on a sleeve which encircles the shaft, and which has formed on it a collar between the pinions. The sleeve revolves with the shaft, and its ends are shaped so as to form in conjunction with the pinions a pair of friction clutches. The two sets of clutch wedges are connected by feathers which pass through the sleeve, so that they are actuated simultaneously by the clutch ring and levers at one end. According to the position of the clutch wedges, either of the pinions can be made to revolve with the shaft, or both can be left free, thus giving full control of the slewing motion.

The whole arrangement of clutches acts admirably, and it has the great advantage of giving full control of the hoisting and slewing movements without stopping or reversing the engine, this being an important point where—as in this case—a single cylinder engine is employed.

The crane is capable of lifting 5 tons with the jib ranging fore and aft, or of lifting and slewing a load of 2½ tons.—*Engineering.*



COMBINED TRACTION ENGINE AND CRANE.

THE gem for January is the garnet, for February the amethyst, for March the bloodstone, and for April the diamond. May has the emerald, June the agate, July the ruby, August the sardonyx, and September the sapphire. The opal belongs to October, the topaz to November, and the turquoise to December.

The Sea Serpent.

PROVIDENCE, R. I., Aug. 7.—The sea serpent seen off Watch Hill, R. I., is reported again in the same district. The sloop Mary Lane, Capt. Delory, was lately on her homeward trip from New London, and when two miles southwest of Point Judith, on Saturday, Capt. Delory sighted a monstrous head two feet above the water and about fifty yards distant. The appearance of the head is described as like that of an alligator. The jaws looked to be at least five feet in length, and were studded with teeth six inches long, while the eyes were as large as the crown of a hat. Back from the head ran a huge fin. The body moved rapidly through the water. The entire length of the creature as estimated in its passing the boat was about seventy feet. The captain says it was within about ten feet as it swept by the vessel. Glimpses of its body, which was about the size of a barrel, showed bright grayish scales.

"Insect Life."

Insect Life is the name of a new periodical which is to be hereafter issued at least once a month by the United States Department of Agriculture, under the editorship of Prof. C. V. Riley, the entomologist, and his assistants. It is to be devoted to the economy and life habits of insects, especially in their relations to agriculture, and is designed to form a speedy and regular means of publication of interesting matter which, for various reasons, cannot be used in the annual reports and which has hitherto been relegated to the archives of the entomological division of the Department of Agriculture. The following are the contents of the first number, which is dated July, 1888: Salutatory; The Corn Pollen Syrphus Fly (illustrated); The Willow Shoot Saw Fly (illustrated); The Sugar Cane Beetle injuring Corn; Extracts from Correspondence; New Species of Oncoenemis; The Australian Parasite of Icerya (illustrated); The Privet Web Worm (illustrated); Notes.

Formation of the Great Lakes and their Changes of Level.

To the June number of the *Forum* Mr. C. K. Gilbert contributes an interesting paper on "Changes of Levels of the Great Lakes," the greater part of which is devoted to the geological history of the formation of these bodies of water. Lakes are formed chiefly by the upheaval of the earth's surface and by its erosion through the movements of glaciers. The beds of the great lakes, with the possible exception of Erie, were scoured out of the solid rock by the great glaciers of the ice age, but accumulations of debris in many cases increase their depth and influence the direction of their outflow. In the case of Erie, for example, the removal of this debris would greatly reduce that lake, perhaps entirely drain it, and would cause it to flow into Ontario and Hamilton. The increase of heat caused the edge of the great glacier to retreat from the southern border at Fort Wayne, where the water resulting from it flowed into the Wabash, and separated Erie and Ontario into two lakes. As long as the ice remained in the valley of the St. Lawrence, the waters found an escape into the Mohawk and Rome. The crest of one of the beaches formed by wave action is marked by the ridge road from Lewiston to Sodus. At this epoch, Erie was but two-thirds as long as it is at present, and its area was but a fifth as great, and Toledo, Cleveland, and the Bass Islands were far inland. When Lake Ontario forced a new outlet through the valley of the St. Lawrence, its level was reduced five hundred feet, and its area 90 per cent, and it thus became 30 per cent smaller than it is at present. The rising of the depressed land to the northward gave the lakes their present dimensions, and the oscillation then received a check. Whether the oscillation has entirely ceased or not, it is now so slow as to prevent the detection of any movement, the present level of the water having remained nearly constant for many centuries.

There are, however, other changes taking place from the action of the rivers. The St. Clair is feebly scouring its channel and forming a delta; the Niagara is eating its way back to Lake Erie; and the St. Marie, Detroit, and St. Lawrence are deepening their channels. All these changes are very slow, and for all practical purposes our inland seas are permanent, and their basins stable. The only modifications that affect our economy are those wrought by the waves upon their coasts. The changes noticed in the water levels are due to the variations in the rainfall upon the lakes themselves, and upon the land drained by the streams that pour into them. The amount of rainfall varies from year to year and from one season to another, and the level of the water oscillates around an average position that remains fixed. The variations in level relate to the entire surface of the lake.

A part of one may be raised and another part be depressed by a gale, especially in the case of Lake Erie, because of its shallowness. A gale has been known to raise the level of one of its ends seven or eight feet, and to depress the other to an equal amount. Differences in atmospheric pressure also affect different parts of the same lake. The rapid change in air pressures, as in the case of tornadoes, sometimes causes rhythmic undulations as high as the largest created by the wind. There are also tides that are as regular as on the ocean, but the highest spring tide rises but about three inches, while the average height is probably not more than one inch.

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Osmose.

It is a well known fact that when two liquids of different compositions are separated by a porous membrane, there will result a double current in opposite directions through the membrane, the consequence is, the two liquids interchange their elements. Observation has shown that one kind of substance, known as *cristalloides*, when dissolved in water, will pass the septum with ease. The others, called *colloides* (gums, etc.), require considerable time for such passage. It becomes evident that if we separate diluted molasses from water by means of a membrane, a portion of the salts will leave the molasses and pass through the membrane into the water. Under these circumstances there would result a liquid, or molasses, the sugar of which might be crystallized. During the osmosing, a certain quantity of sugar is lost, but the reduction of the saline percentage of the molasses is so great that the residuum again constitutes a most valuable secondary product, from which sugar may be extracted. Some experiments have been made to ascertain if there existed any advantage in adding a small quantity of acid to the molasses during this process. It has been found that nearly 30 per cent of the total mineral substances will pass the membrane by the addition of acid, and only 25 per cent under ordinary circumstances.

As the molasses has been diluted by the customary osmosing process, it is evident that the additional water must be evaporated, and this, in itself, represents an extra cost of fuel of no small importance. With every system of osmosing used, it requires considerable experience to determine within what limits the operation may be made profitable.

M. Dubrunfaut, the inventor of the first osmogene apparatus for molasses, called attention to the possible advisability of osmosing the sirups, or even the limed juice prior to evaporation. The objectionable salts would thereby be partly eliminated before the first crystallization, and the quantity of residuum molasses considerably reduced. The working by osmosis of saccharine juices to which lime is added is generally accomplished cold. Through the membrane pass nearly all the salts set free by the lime. The subsequent operations are the same as in the customary methods of working beet juices.

In some cases the profit from working osmogenes is very considerable; it will, therefore, be of the more interest to notice a similar but new process of beet sugar making, advocated by Dubrunfaut just before his death. This method consists in mixing lime with sirups from first centrifugals, allowing them to settle for several days, when the clear portion is osmosed in a boiling condition. The sirup, on leaving the osmogene, may be treated by carbonic acid separately, or added to the limed juices during carbonatation. The water of exosmosis may be evaporated, and worked for the alkalies, etc., it contains.—*The Sugar Beet.*

MACRONUS KETTLEWELLI.

Dr. F. H. H. Guillemard, in his interesting book "The Cruise of the Marchesa," says of his visit to the Sooloo Islands:

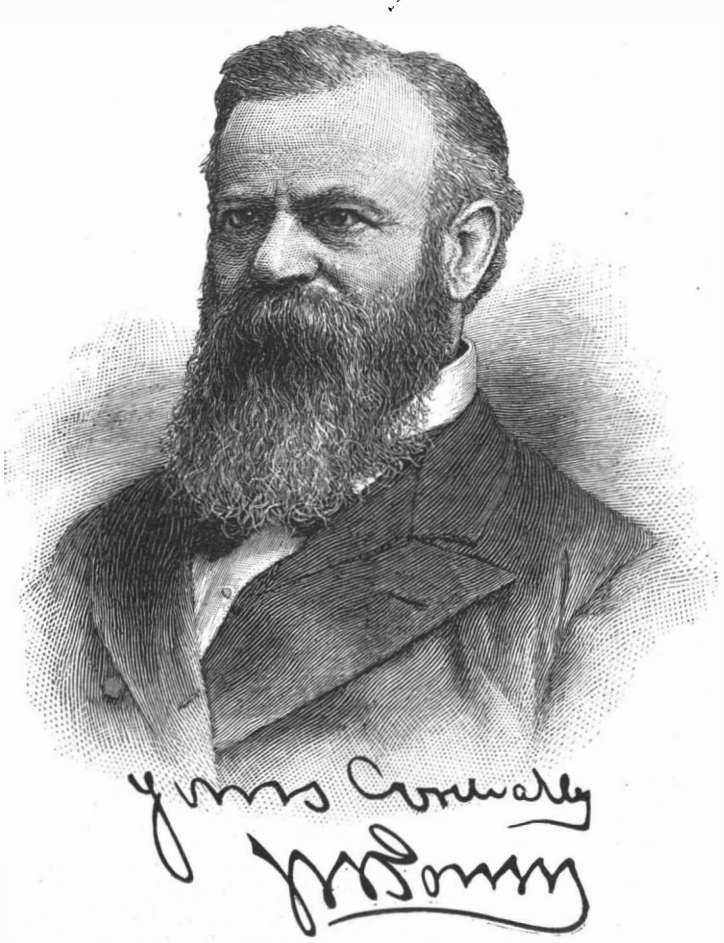
"Our ornithological rambles during this, our second visit to Meimbun, were productive of several species which we had not previously obtained; among others of two or three rare pigeons. Of all parts of the world, the New Guinea region is perhaps the richest in these birds, but we found them tolerably abundant here, and obtained no less than eleven different kinds. But our greatest prizes were two birds hitherto unknown to ornithologists. The first, a bush shrike of brilliant coloring, with the head and shoulders shining bluish black and the rest of the plumage bright orange yellow, I afterward named after the yacht, *Pericrocotus marchesæ*. The other bird (*Macronus kettlewelli*), a babbler, with a curious tuft of white, hair-like feathers springing from the back, was an interesting species, of which we unfortunately obtained a single specimen only." Of this we give an engraving.

THE Tay Bridge, Scotland, is over two miles long, has 86 piers, and spans varying from 58 to 245 feet.

JOHN WESLEY POWELL.

The American Association for the Advancement of Science is migratory. In 1887 it met in New York; in 1888 it gathers its members in Cleveland. A new president, representative as a leader in some special branch of science, is chosen each year. Biology, physics, chemistry, anthropology, and other sciences have been selected in turn. Last year the astronomer Samuel P. Langley* held that office, and this year he yields the place to a distinguished ethnologist.

John Wesley Powell was born in Mount Morris, N. Y., March 24, 1834. He is the son of a Methodist clergyman, and passed his early life in different places in Ohio, Wisconsin, and Illinois. Unable to pursue a systematic college course, he studied at Illinois College and at Wheaton College, meantime teaching at intervals in public schools, and finally he spent the years 1854–56 at Oberlin College, where he followed a special course. His early inclinations were toward the natural sciences, and he began with botany, making collections of various plants. This led him into roving habits, and he made scientific excursions on the Mississippi to St. Paul and across the Wisconsin to Mackinaw. In 1856 he descended the Mississippi in a skiff, from the Falls of St. Anthony to its mouth, and in 1857 he rowed from Pittsburg to the mouth of the Ohio. A year later he went from Ottawa, Ill., down the Illinois River to its mouth, and then ascended the Des Moines River. On all of these trips he made collections of specimens, which he disposed of to various institutions of learning in Illinois, who had come to depend on him for material with which to illustrate their lectures on natural history. He was elected secretary of the Illinois State Natural History Society, and given special advantages for continuing his researches.



At the beginning of the civil war he enlisted as a private in the 20th Illinois Volunteers, and when he reached the rank of lieutenant he was transferred to Battery B of the 2d Illinois Artillery, of which he became captain. He was promoted major and lieutenant-colonel and declined a commission as colonel. He lost his right arm at Shiloh, but on his recovery returned to the front and remained in active service until the close of the war.

In 1865 he accepted the professorship of geology and office of curator of the museum in the Iowa Wesleyan University, but soon resigned to take a similar post at the Illinois Normal University. During the summer of 1867 he visited the Rocky Mountains with his class in geology, thus inaugurating the practice since followed by teachers elsewhere. This success led to his desire to explore the great Colorado River of the West.

The success of his explorations led to his recognition by the government, and in 1870 Congress established a topographical and geological survey of the Colorado River of the West and its tributaries, which was placed under his direction. During the following years a systematic survey was conducted until the physical features of the Colorado valley, hitherto an unknown country, embracing an area of nearly 100,000 square miles, became thoroughly explored. This expedition, originally conducted under the auspices of the Smithsonian Institution, was subsequently transferred to the Department of the Interior and given the title of the Geographical and Geological Survey of the Rocky Mountain Region.

The existence of four separate surveys in the Western Territories conflicting somewhat with each other, and under different departments, resulted, in 1879, in their consolidation, forming the United States Geological Survey, of which Clarence King was appointed director. From the beginning of the controversy* Major Powell was the leading advocate of the consolidation. He represented the Department of the Interior before the committee of the National Academy of Sciences to whom the matter had been referred by Congress for its consideration, and his lucid statement before that body was, perhaps, the most powerful argument showing the necessity of consolidating the surveys that the committee received.

While exploring the Colorado valley he became deeply interested in the remains of the ancient cities of the Moquis, and, next to geology and topography, he made ethnology the chief object of his expedition. The material that he collected on this subject had been deposited with the Smithsonian Institution, and when his survey was stopped, three volumes of "Contributions to North American Ethnology" had been issued, and eight more were in course of preparation.

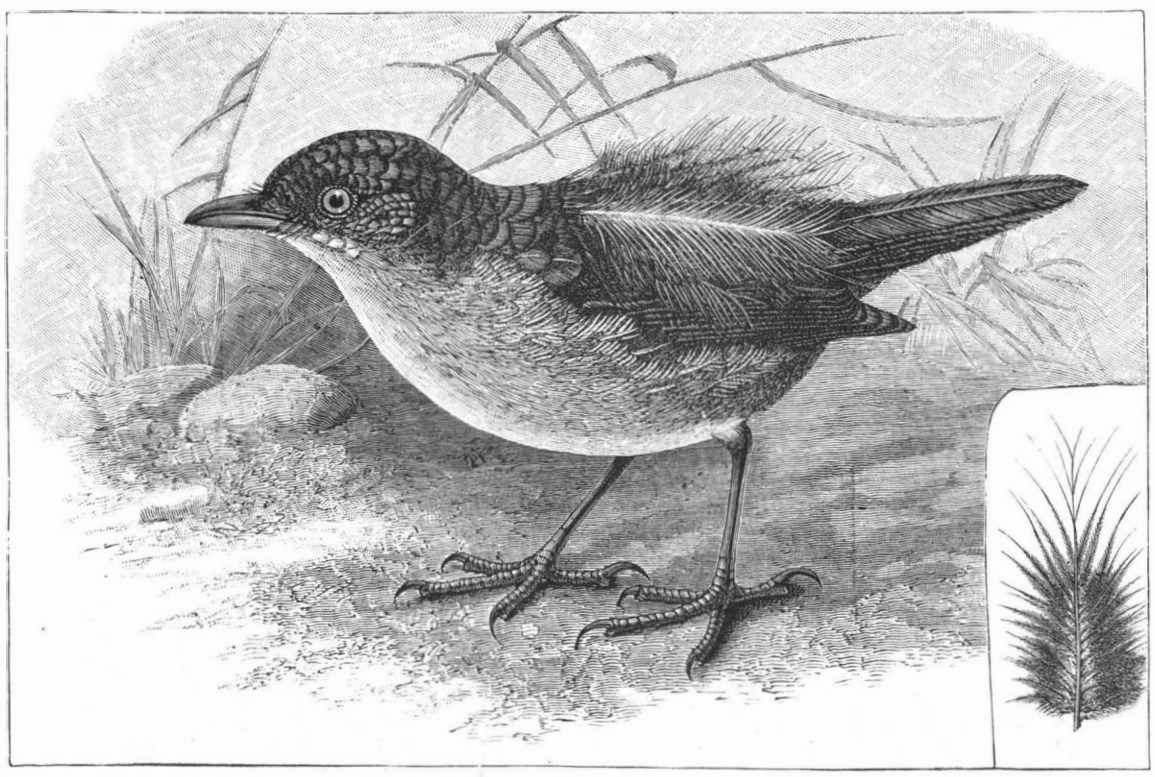
In order to prevent a discontinuance of this work, a Bureau of Ethnology, which has become the recognized center of ethnographic operations in the United States, was established under the direction of the Smithsonian Institution. An appropriation of $20,000 was secured in 1879, and Major Powell was given charge of the work, and has since continued at its head, issuing annual reports, beginning with the volume for 1879–80, and a series of monographs on special topics.

In 1881 Clarence King resigned from the directorship of the United States Geological Survey, and President Garfield at once appointed Major Powell to that place. He has since filled that office, ably administering the work of the greatest survey of the world.

In 1879 the survey was organized by Mr. King on a geographic basis, but with that remarkable power of system so characteristic of its present chief, it has been gradually reorganized, until at present nearly all of the work is classified by kinds. Geology, paleontology, chemistry, and geography are assigned to separate divisions. The geology is subdivided, partly by the nature of the phenomena, as

* See the sketch of Samuel P. Langley, in the SCIENTIFIC AMERICAN for August 20, 1887.

* A description of the early history of the national surveys is given in the sketch of Ferdinand V. Hayden, contained in the SCIENTIFIC AMERICAN for January 7, 1888.



MACRONUS KETTLEWELLI.

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the geology of quicksilver, volcanic geology, lithology, partly by stratigraphic divisions, as Archean geology, and partly by areas, as originally planned by Mr. King. The paleontologic work is classified partly on biological grounds, the vertebrates, invertebrates, and plants falling into separate divisions, and is further divided on stratigraphic lines, invertebrate paleontology being separated into paleozoic, mesozoic, and cenozoic. In the chemical division the necessary analytical work is performed, as well as various independent researches on physics and mineralogy. The principal divisions of the geographic work are areal.

For the further development of the survey two propositions are now before Congress, both favored by the director of the survey, but both originating with the citizens of Western States. The first is a proposition to make a special investigation of the subject of irrigation, selecting the lands which should be devoted to agriculture with irrigation, and indicating for reservation the sites of irrigation canals, headworks, and reservoirs for the storage of irrigation waters. The second proposition is for a special agricultural survey in connection with the general geologic work.

Major Powell has had in recent years but little time for original work, but he has not been unproductive. He constantly furnishes ideas to his assistants which they assimilate and develop. He is intimately acquainted with the scientific work of the survey, and his fruitful mind guides by suggestion, or more explicit direction, a large share of the work. The ordinary bureau chief in Washington assumes a judicial attitude toward the work under his direction, deciding the questions that are propounded to him by his assistants or by outside parties. Major Powell, on the other hand, is exceptional in that he takes the initiative himself, originating plans and finding means for their execution. The appropriations with which this work is carried on have been increased from $106,000 in 1879 to $750,000 in 1887.

His personal scientific work during the last ten years has been chiefly in anthropology. He had previously made and has since continued extensive observations in the linguistics, mythology, and sociology of American tribes, but this still remains largely unpublished. His published contributions have been principally devoted to the philosophy of the subject. These include his presidential addresses before the Anthropological Society of Washington, of which the titles of the more important are, "Outlines of Sociology" (1882), "Human Evolution" (1884), "From Savagery to Barbarism" (1885), "From Barbarism to Civilization" (1886), "Evolution of Civilized Man" (1888), and his contributions to the "Annual Report of the Bureau of Ethnology."

The degree of Ph.D. was conferred upon him by the University of Heidelberg on its 500th anniversary in 1886, and in the same year Harvard gave him an LL.D., on the occasion of her 250th anniversary. He is a member of many scientific societies, of which the most important is his connection with the National Academy of Sciences, where he was elected in 1880. Major Powell was president of the Anthropological Society of Washington from its organization in 1879 till 1888, and he was president of the Philosophical Society of Washington in 1884. He was elected a member of the American Association for the Advancement of Science in 1874, advanced to the grade of fellow in 1875, and served as vice-president in 1875, delivering an address that year on "Mythologic Philosophy," which was a most valuable contribution to anthropology, and resulted in calling the attention of the Association to the progress in that science, in consequence of which Lewis H. Morgan, the father of anthropology in this country, was chosen to the presidency of the Association for the following year.

At the New York meeting last August, Major Powell was elected to the office of president, and will conduct the sessions in Cleveland this year.

Major Powell's publications include many scientific papers and addresses and numerous government volumes that bear his name, including the reports of the various surveys with which he has been connected, the Bureau of Ethnology, and the United States Geological Survey. In addition to the works already mentioned, the special volumes that are more particularly his own are, "Report on the Geology of the Eastern Portion of the Uinta Mountains and a Region of Country Adjacent Thereto" (Washington, 1876), "Report on the Lands of the Arid Region of the United States" (1879), and "Introduction to the Study of Indian Languages" (1880).

IN the Academy of Sciences, Paris, on the snows, ice, and waters of Mars, M. Flammarion, in reply to some recent remarks on the meteorological condition of this planet, pointed out that the varying state of the polar ice caps has long been carefully observed by Maedler, Schiaparelli, and others, the inference being that Mars is not in a state of glaciation. On the contrary, its temperature is equal to, if not higher than, that of the earth, and its polar snows melt periodically to a far greater extent than on our planet.

[SCIENCE.]

Object Lessons in Oriental Faiths and Myths.

A remarkable collection will soon be opened to the world in Paris. The municipality has given a plot of ground that cost two hundred thousand dollars on the Avenue d'Jena, and a large and beautiful stone structure has been erected on it by the state, under a law passed while the present president, Carnot, was finance minister. This law secures over three hundred thousand dollars for the erection of a building, and endows the establishment thus formed with a perpetual annuity of nine thousand dollars for purposes of maintenance. The glass cases for the collection are partly placed and filled, and the public will be admitted in a few months.

The collection is primarily intended to teach the history of the development, and the characteristics, of the Oriental religions. The importance of this study strikes us forcibly when we reflect that these forms of faith still deeply influence the daily lives of more than one-half of the human race, and that they have solaced and guided tens of thousands of millions of our fellow creatures.

The originator and collector of this unique series of objects is the well known student of Oriental languages, M. Etienne Emile Guimet, the son of a wealthy citizen of Lyons. He has spent more than twenty years of an active scholarly life in voyages to, and residences in, China, Japan, and other Asiatic lands, and has devoted several millions of francs from his large fortune to this work of public instruction. In his native town he is also known for his persistent and munificent efforts to secure high class musical entertainments for the people; and, if his efforts are measured by the exquisite congregational singing that I recently heard in one of the Lyons churches, his efforts have been signally successfull.

Recently I spent the morning with M. Guimet, examining the collections already in place. We first passed through two long halls, carefully arranged, and lighted from both sides with high windows—halls, let me say, that would form admirable models for the future architects of the Metropolitan Museum. Here we found two comprehensive collections of pottery—one from China and one from Japan—each arranged geographically and historically, beginning, in the case of Japan, with the southern provinces, and ending with the northern. These most valuable gifts of M. Guimet, however, do not belong to my present subject.

From these halls we entered the lofty library, where are already placed twelve thousand volumes of books and manuscripts containing official statements in the original tongues of the dogmas, creeds, and myths of all the important Oriental forms of belief. Thence we passed to an extensive hall, in which the Japanese religions are illustrated and classed.

Illustrations of the earliest form of the Shinto nature worship begin the extensive series. First we have the round metal mirrors resting upon mimic waves of sculptured wood, that stood high in the temple to catch the earliest rays of the rising sun; then figures of the simply clad priests; then the implements for making the primitive offering of fire and incense to the unembodied god. In order of time follow the paraphernalia of the Buddhist priests, who, crossing from Corea, brought with them their gorgeous ritual and imposed it upon the nation. Then we have innumerable figures of Buddha and attendant deities in gold, silver, bronze, lacquer, and clay, representing the ideas of the important contending sects into which Buddhism was soon divided through the agency of sacerdotal ingenuity.

In the middle of the hall, under the skylight, is a representation of the interior of a Japanese temple of the first class, with original images of all the gods before whom worship is usually conducted. Here we may see how, in the imagination of the Japanese (the sacred Buddha sends forth four great agencies that save men through persuasion), they are shown to the popular eye in the form of golden figures of prophets in silken robes; and also how four other emanations from Buddha, symbolical of darkness, compel men to do right through fear, shown as carved images of black devils with gnashing teeth.

Beyond this group are series of cases containing thousands of objects explaining Japanese myths, lives of saints, and the stories told about their sacred people and places. Another extensive hall contains a series of figures and other objects elucidating the forms of belief, the myths, and the folk lore of China. In another the Greek mythology is systematized, in another the Roman, in another the Egyptian. One of the most interesting cases is that containing original images from many places in the countries and islands bordered by the Mediterranean, showing the various steps by which the Egyptian gods were accepted and adopted under new names successively by the Greeks and by the Romans. The rooms containing the collections from the western lands are as yet but partly arranged. Enough can be seen, however, to show how important and complete the series of objects must be—enough to show that the world furnishes no other collection of the kind nearly so large, or so well prepared for the serious study of the development of Oriental and ancient civilization.

M. Guimet declared that he had no theory to support in forming his museum. He has excluded the Christian and the Hebrew forms of worship from his scientific treatment, and has confined himself to those lands where religion dawned upon mankind, and where great faiths that dominated extensive territories were developed. He simply presented the authentic documents and the authorized symbols for the use of the scholar.—*L.*

Curiosities of Coal.

Does any one except a practical chemist ever stop to think of all the substances which we get from pit coal and the almost inconceivable variety of their uses? Everybody is familiar with those of them that are in daily use, such as gas, illuminating oils, coke, and paraffine, but of the greater part few persons know even the names, science advances so rapidly and its nomenclature is so extensive and so abstruse. It is no wonder that merchants and manufacturers take advantage of this ignorance to foist upon the public articles of food, of drink, or for the toilet that, if they are not always dangerous to the health, have not in them a particle of the substances which they pretend to contain. Though pit coal has been known for some hundreds of years, the discovery of its numberless products is confined to the present century. Illuminating gas was unknown a hundred years ago. Petroleum has been in use only about forty years, and it is scarcely more than fifty since some one discovered that stone coal was inflammable. Nearly all the other products derived from soft coal have been discovered and applied in the interests of science or of fraud within the last twenty-five years. The first thought in regard to coal is that it is made to give heat or warmth; the next that one of its principal uses is to illuminate. But there are obtained from it the means of producing over four hundred colors, or shades of color, among the chief of which are saffron, violet blue, and indigo. There are also obtained a great variety of perfumes—cinnamon, bitter almonds, queen of the meadows, clove, wintergreen, anise, camphor, thymol (a new French odor), vaniline, and heliotropine. Some of these are used for flavoring. Among the explosive agents whose discovery has been caused by the war spirit of the last few years in Europe are two called dinitrobenzine, or bellite, and picrates. To medicine coal has given hypnone, salicylic acid, naphthol, phenol, and antipyrine. Benzine and naphthaline are powerful insecticides. There have been found in it ammoniacal salts useful as fertilizers, tannin, saccharine (a substitute for sugar), the flavor of currants, raspberry, and pepper, pyrogallic acid and hydroquinone used in photography, and various substances familiar or unfamiliar, such as tar, rosin, asphaltum, lubricating oils, varnish, and the bitter taste of beer. By means of some of these we can have wine without the juice of the grape, beer without malt, preserves without either fruit or sugar, perfumes without flowers, and coloring matters without the vegetable or animal substances from which they have been hitherto chiefly derived.

What is to be the end of all this? Are our coal beds not only to warm and illuminate, but to feed and quench the thirst of posterity? We know that they are the luxuriant vegetation of primal epochs stored and compressed in a way that has made them highly convenient for transport and daily use. They are nature's savings laid up for a rainy day of her children, the human race, and it is probably because they are composed of the trees, the foliage, the plants, the roots, the fruits, and the flowers of the ancient world that they now so largely supply the place of our forests, plains, fields, and gardens.—*San Francisco Chronicle.*

Large Photographs of a Great Job.

We are indebted to Messrs. B. C. Miller & Sons, house movers, 979 Bergen Street, Brooklyn, for a set of three large and splendid photographic pictures, showing the moving of the great Brighton Hotel, at Coney Island, N. Y., in April last. In the SCIENTIFIC AMERICAN for April 14 we gave illustrations showing how the building was moved by means of railway cars and locomotives. One of the photograph pictures is 3 feet 9 inches long, and shows the locomotives and connected tackle arrangements in working order. The building was 460 feet long, 210 feet wide, and weighed 5,000 tons. The arrangement of the tracks and cars by which this great load was moved is clearly shown in the pictures, which have a peculiar value as original illustrations of a novel and remarkable undertaking.

A Trade Mark Case.

In the case of the Russian Cement Company *vs.* Le Page, decided recently by the Supreme Judicial Court of Massachusetts, it appeared that the appellee formed a corporation to which he sold his business with the right to use his trade mark, "Le Page's Liquid Glue." He afterward left the corporation and made use of the name, "Le Page's Improved Liquid Glue." The court granted an injunction enjoining the appellee from making use of the latter name.

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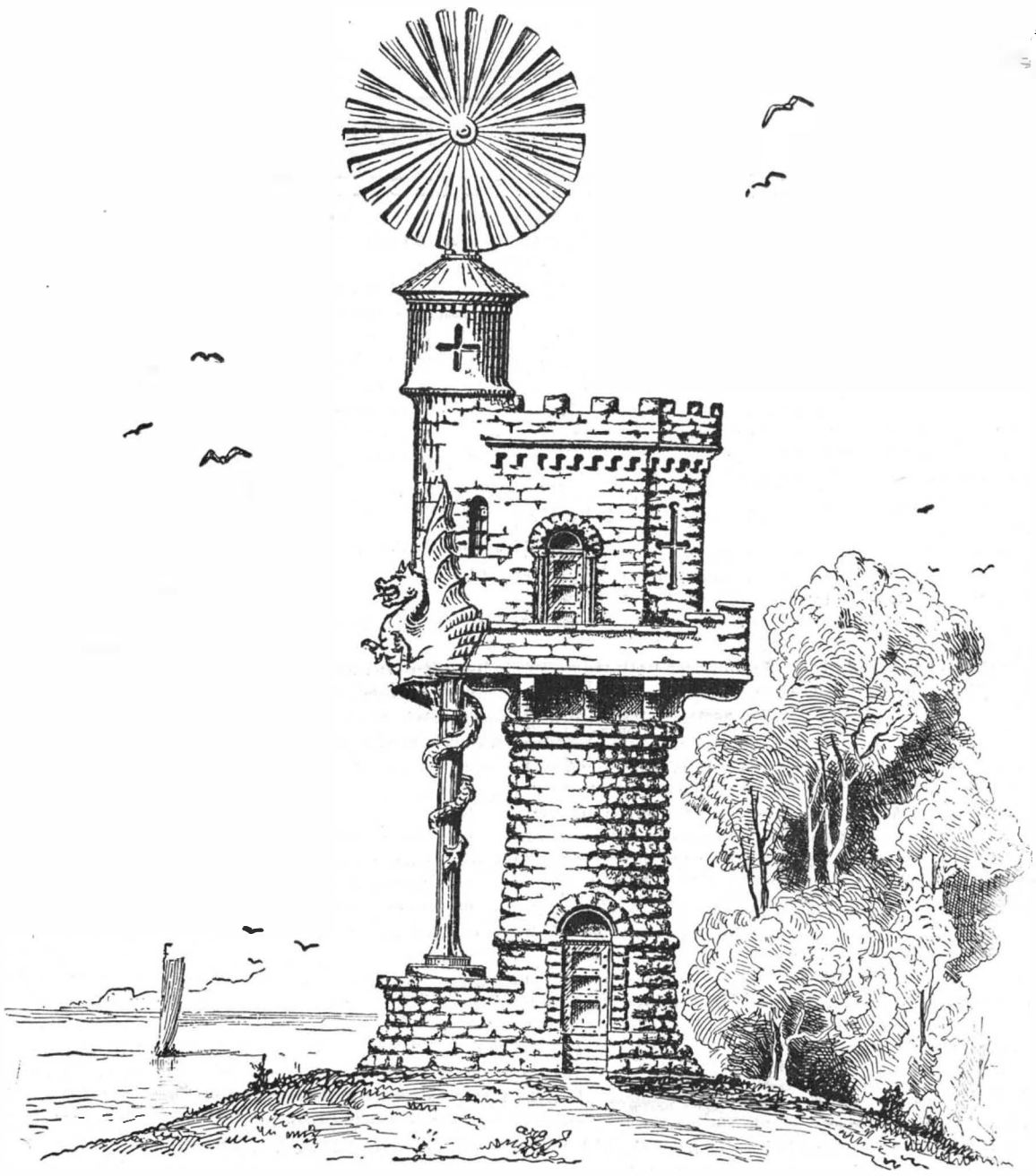
DESIGN FOR A WINDMILL TOWER AND WATER TANK.

The accompanying design for a windmill tower is worthy of attention for the novelty and boldness of its conception. It is a striking departure from the common plan of such structures, which are ordinarily devoid of taste or elegance. This design shows how prettily such a subject may be treated. The example we give will serve a useful purpose in leading owners and builders to think and study how they may improve the forms and lines of all such structures. This windmill was erected at Narragansett Pier, R. I., by Edward Earle, Esq., to supply water for ten cottages built by him at that place. It was designed by Constable Brothers, engineers and architects, of this city, and, in its position among the summer cottages at Narragansett Pier, forms a very ornamental addition to the landscape. The water is supplied by driven wells, and is pumped up by the wind power into the reservoir at the top of the tower, whence it is distributed by gravity pressure throughout the ten cottages erected adjacent to it. It has proved adequate for all demands made upon it, and not only furnishes an abundant supply of water for domestic purposes, but provides an ample means of fire protection.

The engraving we take from the March, 1887, number of the BUILDERS EDITION of the SCIENTIFIC AMERICAN.



TOWER AND WATER TANK AT NARRAGANSETT PIER, R. I.

Manufacturing Ice.

Strolling into one of these factories recently, in the belief that it would be cool, but finding that it was actually the hottest place he had been in during the entire day, an *American* reporter watched the process.

Passing through the outer office, you get abruptly into the factory, an enormous apartment and very lofty. Three graceful engines from fifteen to twenty-five feet tall were moving with mysterious strength at the head of the apartment, and several big pipes overhead connected them with the floor below and an upper room.

Negro men were walking about over square places in the floor, and occasionally lifting the lid of one, they took out of it with a crank a block of ice weighing 200 pounds. This was attached to a chain suspended from a double bridge truck, rolled to one side, and tipped through a hole in the wall into the ice house.

There are in this factory about 1,000 of these little tanks. Each is filled with water distilled from the steam of the three engines; and each tank, which is made of galvanized iron, rests in a well of brine or salt water. Running about under these tanks, which form a flooring over the whole place, is a continuous coil of iron pipes, charged with ammonia, that penetrate the wells of brine and keep the salt water at a temperature of twelve degrees. After filling the tank with the distilled water it is left undisturbed for thirty-six hours. The lid is then raised, the iron tank or can is drawn up and dipped into a small vessel containing boiling water to melt the ice from the interior sides that it may be removed. This is the large block of ice one sees in the ice wagons. The ammonia comes from a factory at Wilmington, Del., in iron retorts carefully packed and air tight. When it is about to be used, a tiny escape is made through which the ammonia oozes in a gaseous form, though the contents of the retort are liquid. This gaseous ammonia is transferred directly to the submerged coils of pipe. Two charges during the summer will run a factory of fifty tons daily capacity. After this gas has performed its mission and passed through all the pipes, the engines suck it through the pipe overhead, pass it to the upper floor, and force it through pipes submerged in cold water, where it is condensed. It is then received into a large tank below and made ready for another tour of the pipes in the form of gas. In its rounds the gas makes more or less escape to the open air and is lost for all time, but very little is lost and the same ammonia is used until it is consumed by the escapes. Three hundred thousand pounds of ice are used every day in Nashville and the towns for 100 miles around. One of these factories turns out thirty-five tons daily; the other produces forty tons, and there is being brought here eighty tons of lake ice. The three companies manufacturing and importing ice into Nashville sell to the small dealers, who supply the consumers. They also ship to the neighboring towns. But the larger portion of this 300,000 pounds per day is consumed in Nashville.—*Nashville American.*

Excavating and Handling Rock.

The "Charcoal Iron Workers" publishes a paper on the cost of excavating and handling rock, originally presented by Mr. Roger Rigly before the Western Pennsylvania Mining Institute, of which the following is a summary. The average weight of a cubic yard of sandstone or conglomerate in place is given as 1·8 tons, and of compact granite, gneiss, limestone, or marble, 2 tons, or an average of 1·9 tons, or 4,256 pounds. A cubic yard when broken up ready for removal increases about four-fifths in bulk, and one-fourteenth of a cubic yard, or 177 pounds, is a wheelbarrow load. Experience shows that with wages at $1 per day of 10 hours, 45 cents per cubic yard is a sufficient allowance for loosening hard rock. Soft shales and allied rocks may be loosened by pick and plow at a cost of 20 cents to 30 cents per cubic yard. The quarrying of ordinary hard rock requires from ¼ pound to ⅓ pound, and sometimes ½ pound, of powder per cubic yard. Drilling with a churn driller costs from 12 to 18 cents per foot of hole bored. Upon these data Mr. Rigly estimates the total cost per cubic yard of rock in place, for loosening and removing by wheelbarrow (labor assumed at $1 per day of 10 hours), as follows: When distance removed is 25 feet total cost=$0 537, when 50 feet $0·549, when 100 feet $0.573, when 200 feet $0·622, when 500 feet $0·768, when 1,000 feet $1·011, and when 1,800 feet $1·401. This is exclusive of contractor's profit.

When labor is $1.25 per day, add 25 per cent to the cost prices given; when $1.50 per day, add 50 per cent, and so on. In hauling by cart, the cost of loading, which will be about 8 cents per cubic yard of rock in place, and the additional expense of maintaining the road, must be added. Allowing, then, 851 pounds as a cart load, the total cost per cubic yard is estimated, when removed 25 feet, at $0·596, when 50 feet $0·599, when 100 feet $0·605, when 200 feet $0·617, when 500 feet $0·655, when 1,000 feet $0·717, and when 1,800 feet $0·94.

Crystallized Fruits.

The following is the prize essay on this subject, by J. J. Pratt, superintendent of the Sutter Packing and Canning Company, read at the last meeting of the California State Board of Horticulture:

The process of preserving fruits in a crystallized or glaced form is attracting considerable attention at the present time. This process, though comparatively new in California, has been extensively operated in Southwestern France for years, the United States having been heavy importers, paying fancy prices for the product. The process is quite simple. The theory is to extract the juice from the fruit and replace it with sugar sirup, which, upon hardening, preserves the fruit from decay and at the same time retains the natural shape of the fruit. All kinds of fruit are capable of being preserved under this process. Though the method is very simple, there is a certain skill required that is only acquired by practice. The several successive steps in the process are about as follows: First, the same care in selecting and grading the fruit should be taken as for canning; that is, the fruit should be all of one size and as near the same ripeness as possible. The exact degree of ripeness is of great importance, which is at that stage when fruit is best for canning. Peaches, pears, etc., are pared and cut in halves as for canning; plums, cherries, etc., are pitted. The fruit having thus been carefully prepared is then put in a basket or bucket with a perforated bottom and immersed in boiling water. The object of this is to dilute and extract the juice of the fruit. The length of time the fruit is immersed is the most important part of the process. If left too long, it is overcooked and becomes soft; if not immersed long enough, the juice is not sufficiently extracted, which prevents a perfect absorption of the sugar. After the fruit has been thus scalded and allowed to cool, it can again be assorted as to softness. The next step is the sirup, which is made of white sugar and water. The softer the fruit, the heavier the sirup required. Ordinarily, about 70° Balling's saccharometer is about the proper weight for the sirup. The fruit is then placed in earthen pans and covered with sirup, where it is left to remain about a week. The sugar enters the fruit and displaces what juice remained after the scalding process. The fruit now requires careful watching, as fermentation will soon take place, and when this has reached a certain stage the fruit and sirup is heated to a boiling degree, which checks the fermentation. This heating process should be repeated as often as necessary for about six weeks. The fruit is then taken out of the sirup and washed in clean water, and is then ready to be either glaced or crystallized, as the operator may wish. If glaced, the fruit is dipped in thick sugar sirup and left to harden quickly in open air. If it is to be crystallized, dip in the same kind of sirup, but is made to cool and harden slowly, thus causing the sugar which covers the fruit to crystallize. The fruit is now ready for boxing and shipping. Fruit thus prepared will keep in any climate and stand transportation.

THE New York *Times* says: "The plans for two new harbor defense vessels attributed to the navy department are in some respects the most novel yet attempted in the way of naval construction. The charge of imitating European types cannot certainly be brought against these vessels, since nothing like them is known. It is true that the single-turreted monitor type, which is said to have been adopted, is familiar enough; but such a vessel, of only 3,500 tons, yet able to carry a 16 inch gun in its turret and a dynamite gun in its hold, and developing a speed of 18 knots, must indeed be an original craft. The double-turreted monitors, having a displacement of 3,887 tons, or not far from the one proposed, carry two 10 inch guns in each turret, except the Puritan, which is of 6,000 tons, and is said to be intended to carry 10½ inch guns. The difference between that and a 16 inch gun is enormous."

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ENGINEERING INVENTIONS.

A motor has been patented by Mr. George W. Wimpee, of Summerville, Ga. Combined with the reciprocating piston rod of a steam or gas engine and the main crank and connecting rod of the motor are lazy tongs or compound levers arranged to increase the throw of the connecting rod, and thus permit of a longer crank and increased leverage.

An anti-dead-center crank has been patented by Mr. Thomas C. Thomas, of Salt Lake City, Utah Ter. The invention consists of a crank arm connected by a crank pin with an arm carrying an adjustable plate held at right angles to the crank arm, and carrying a second crank pin, for transmitting power with little loss and avoiding any dead centers.

A gas motor engine has been patented by Mr. Hugh Williams, of Stockport, Chester County, England. It has charging and power cylinders of different diameters, with pistons operating as a single piston, mixed gas and air being compressed into a reservoir by the charging cylinder, and flowing thence into the power cylinder, where it is further compressed by the power piston before explosion, duplicate engines being employed coupled to one shaft.

AGRICULTURAL INVENTIONS.

A corn shocker has been patented by Mr. Edward F. Evans, of Wamego, Kansas. This invention covers novel features of construction intended to simplify the device, so that it may be readily carried from shock to shock and conveniently placed for use by one person, and the shock readily compressed and tied, without danger of tilting or overturning it.

A spring attachment for agricultural implements has been patented by Mr. Charles R. Hartman, of Vincennes, Ind. It is for use where one or more plows, shovels, or gangs are to be lifted from the ground by the action of the spring while turning the implement at the end of the row, or to assist the operator in guiding the machine, the invention covering a novel construction and combination of parts therefor.

MISCELLANEOUS INVENTIONS.

A draught lever has been patented by Mr. Frederick R. Webster, of Nashua, N. H. This invention provides a novel construction of a simple apparatus, whereby a railway rail and heavy timbers may be expeditiously and conveniently moved without injury thereto, and with slight exertion on the part of the operator.

A chopping knife and slicer has been patented by Mr. Harvey W. Bridgman, of Lyons, Kansas. The handle has a transverse opening and a slicing blade across one end of the opening, there being secured to the handle a shank having three arms, each one of which carries a curved blade with converging taper ends.

A cuff holder has been patented by Mr. Benjamin F. Walker, of Warren, Pa. It is applicable to both men's and women's apparel, and has a spring clamp with terminally dentated pivoted jaws, a spring keeping the jaws closed on the cuff, while there is a safety pin for attaching the cuff holder to the sleeve of the coat or dress.

A watch case pendant has been patented by Mr. Frederick W. Schimmel, of Murray, Idaho Ter. This invention covers a novel construction and arrangement of parts in a watch pendant and push pin, designed to exclude dust and moisture, and also providing means for holding the pendant bow securely in the pendant.

A vacuum apparatus has been patented by Mr. Otto Bielmann, of Jersey City, N. J. It is for crystallizing sugar, and consists of a vacuum pan of polygonal form, having a shell tapering toward the ends, and mounted to rotate on fixed heads held on a shaft or spindle, through which steam is supplied to a coil in the middle of the pan.

A combined step ladder and chair has been patented by Mr. Phillip Braun, of Los Angeles, Cal. This invention covers a novel construction and combination of parts designed to provide a convenient and ornamental piece of furniture, simple, light, and durable, which may be readily converted from a chair into a step ladder and *vice versa*.

An electric insulator peg has been patented by Mr. William E. Joslin, of South Scituate, R. I. It is made of wood, with threaded head and tapering neck, the shank forming a smooth non-shouldered continuation of the neck, making a peg which is strong without being unduly stiff, and affords no room for water to lie around the shank.

A grain dumping device has been patented by Messrs. James P. and John R. Sevier, of Opel, Mo. It is a combined grain carrier and elevator, designed to enable one unaided to conveniently transport a load of grain, elevate it, and discharge it into a storage or other bin without the necessity of handling the grain, as with a scoop.

A sash holder has been patented by Messrs. George K. Snyder and Comodore P. Fisher, of Clay Centre, Kan. It consists of a rod with reversely screw-threaded ends engaging a plate and a bracket screwed to the window frame, with other novel features, making a simple device for securing the sash at any desired point, and securely locking it when closed.

A screw propeller has been patented by Mr. Alfred Conrad, of Patchogue, N. Y. The propeller is made with an elongated tapering hub, fitted by its axial bore on a screw shaft, and having a single continuous perpendicular helical integral flange, which gradually increases in diameter from the smaller to the larger end of the hub.

A draught equalizer has been patented by Mr. William Cazier, of Waveland, Kansas. It is designed to equally distribute the strain when three animals are attached to a vehicle or plow in connection with which the equalizer is employed, its construction being such that draught animals will be held very close to the plow, implement, or vehicle.

A chemical stove has been patented by Mr. William M. Conway, of Baltimore, Md. It is designed for affording heat by slaking quicklime with water, having one or more pans for the lime arranged within a cylinder, in connection with a charger and a water tank, whereby a high temperature can be readily maintained with but little care and labor.

An improvement in suspenders forms the subject of a patent issued to Mr. Victor Dubreuil, of New York City. This invention covers a novel construction and arrangement of the several parts, making a suspender designed to fit the body of the wearer, without inconvenience, the article having but few parts and being simply made.

A conical wheel has been patented by Mr. Aaron Twyman, of Pullman, Ill. It has its circumference radically conical, and provided at its center with a journal bearing, the surface of which is concentric and parallel with the outer peripheral surface of the wheel, whereby to present a bearing surface at right angles to the resultant of the pressure upon the wheel.

A paper bag holder has been patented by Mr. James Cochran, of Custer City, Dakota Ter. It consists of a number of U-shaped sections or slides fitted together and varying in height and width, the bags being held horizontally in the several sections and projecting beyond each end so that the user is enabled to remove the bags from either end of the holder.

A micrometer scale has been patented by Mr. Edmund Jones, of Cold Spring Harbor, N. Y. It has a straight edge with a longitudinal scale and a lateral extension with a transverse scale, a gauge being mounted to work on this extension on a transverse guide, with other novel features, to facilitate measuring or plotting distances.

A hair tonic has been patented by Mr. William T. Wallace, of Troy, Texas. It is made of tincture of cantharides, oil of cocoa, castor oil, ammonia solution, alcohol, bay rum, borax, flowers of sulphur, oil of bergamot, and other ingredients, and is designed to prevent hair from falling out and promote its growth where the follicles are not dead.

An album has been patented by Mr. Felix Reifschneider, of Brooklyn, N. Y. It is a book in which the leaves form photographic mounts, and are readily attachable and detachable, being designed for the use of photographic amateurs, the photographs being pasted in and afterward burnished, without damaging in any way their means of attachment.

A vehicle brake has been patented by Mr. Andrew W. Lane, of Susanville, Cal. It is constructed with novel-shaped side clips, each having an overhanging flange or lip, one clip being adapted to be permanently bolted to a brake bar, and the other being adjustable, whereby blocks of almost any thickness may be conveniently clamped to place to act as shoes.

A nut lock has been patented by Mr. Wiley S. Keyes, of Verona, Miss. It is especially designed for use in connection with railroad rails and fish bars, the improvement consisting in a polygonal bolt screw-threaded upon one end to receive the nut and to receive a key which fits in a recess in the nut longitudinally of the bolt to bear upon one of its flattened surfaces.

A plaque or panel has been patented by Mr. Edward De Planque, of Hoboken, N. J. It is formed of two sheets of canvas or duck united by a mixture of glue, whiting, and pulverized wood, with a sheet of paper fastened to one of the sheets of canvas or duck, and the sheet of paper having a coating of whiting and glue, on which the painting or drawing is produced.

A velocipede has been patented by Mr. George Kibbe, of Amsterdam, N. Y. This invention covers a novel form of pedal levers and driving mechanism, with a peculiar construction and arrangement of the steering head and cross bar, to render the propulsion of velocipedes easier, and provide for a convenient variation of the effective driving force in accordance with the resistance to be overcome.

A buckle has been patented by Mr. Luther C. Voorhees, of New York City. It is made of plate or sheet metal, and has a lower hook and closing spring or tongue integral with the frame or body of the buckle, which has parallel slots one above the other, and a row of teeth along the marginal portion of one of the slots for the passage of the web or strap to which the buckle is to be applied.

An automatic vehicle brake has been patented by Messrs. Linford E. Van Antwerp and Morgan L. Norton, of Susquehanna, Pa. It has stirrups carrying brake shoes pivotally connected with a sliding brake beam, a suitably supported and arranged spring bearing against the stirrups, with other novel features, to slacken the speed or stop a forwardly running vehicle, while allowing it to back freely.

A fish hook has been patented by Mr. George Smith, of Brooklyn, N. Y. It is made of spring wire bent upon itself to form a double shank, the two ends bent out to form the hooks, a sleeve being held to slide upon the double shank in such a way that a fish drawing upon the hooks will cause the shank to slide through the sleeve, when the shank with the hooks at its ends will expand in the mouth of the fish.

A rotating trolling device for ships' logs has been patented by Mr. Oscar Kustel, of San Francisco, Cal. It consists of a plate twisted and having its longitudinal margins bent in reverse directions, forming curved flanges, with a wire secured on opposite sides of the plate along the longitudinal edges by the flanges, the rotator having at its forward end a rounded eye or loop through which the drag line is fastened.

A process of treating native soda has been patented by Mr. Laurence F. J. Wrinkle, of Virginia City, Nevada. It is a novel method of treating natural soda from alkaline lakes, whereby the bicarbonate is saved, and the crystal soda obtained free from sand, and to a larger extent from salt and sulphate, the process being less expensive than that heretofore followed.

A tanning process has been patented by Mr. Charles H. Perrin, of Jefferson City, Mo. It consists in first depilating the hides or skins, then steeping them in an infusion of black sage brush in water first heated to a high temperature and afterward allowed to stand and partially cool, stirring them subsequently at intervals, such process being also applicable for treating hides or skins before the hair or wool is removed.

A vehicle axle has been patented by Mr. La Fayette T. Wever, of Sopchoppy, Fla. It is enlarged and exteriorly threaded at its ends, with a longitudinal aperture having a thread of coarser pitch, a threaded spindle adapted to enter the aperture, with a plain collar in front of the thread, and an interiorly threaded flanged sleeve sliding upon the spindle and locking the spindle and axle, making the axle strong at its union with the spindle, the latter being readily removable in case of breakage.

SCIENTIFIC AMERICAN
BUILDING EDITION.

AUGUST NUMBER.—(No. 34.)

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NEW BOOKS AND PUBLICATIONS.

THE ANIMAL LIFE OF OUR SEA SHORE. By Angelo Heilprin. Philadelphia: J. B. Lippincott Co. 130 pp. 50 cents.

This is a little hand book intended to meet the requirements of the popular mind, and calculated to be exceedingly interesting to those who have not made a specialty of the subjects treated of, but still find an attraction therein as different objects casually present themselves, especially during the summer vacation. The book has especial reference to the New Jersey coast and the shores of Long Island, and treats more especially of the shell fish, jelly fishes, star fishes and sea cucumbers, worms, moss polyps, sponges, etc.

"THE INTERNATIONAL ANNUAL" OF ANTHONY'S PHOTOGRAPHIC BULLETIN. Vol. I. 1888 By A. H. Elliott, Ph.D., F.C.S, New York, and W. Jerome Harrison, F.G.S., London. E. & H. T. Anthony & Co., New York; H. Greenwood & Co., London. Pp. 643. Price $1.

This handy book is a novelty in its way, since it is intended to be an annual record of photography in both the Eastern and Western worlds, as elucidated by the

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best writers and scientific experimentalists. In it we have the opinions and writings of English, American, German, and Austrian photographers side by side, which is of itself a new but very agreeable departure Many of the articles are of practical value to both the amateur and professional photographer. It contains seven photogravure illustrations made by five different processes, some of which are fully explained.

There is also much valuable information on emulsions, special developers, and photo-engraving processes, besides illustrations of new and novel apparatus.

We commend the book as a reliable guide to any disposed to take up photography.

THE PHOTOGRAPHER'S BOOK OF PRACTICAL FORMULÆ. Compiled by W. D. Holmes, Ph.B., and E. P. Griswold. Published in New York. 1888. Pp. 237. Price 50 cents.

In this book are published nearly all of the reliable formulas of the present time, relating more especially to the most approved developers, the wet plate process, intensifiers, carbon process, toning baths, albumen and bromide printing processes, and many other useful things desirable for a photographer to have for convenient reference. The authors state that it is not specially original, but is merely a compilation of well known formulas. It is well printed and contains much useful information. It should be found in the laboratory of every practical photographer. Any of the above books may be purchased through this office.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) F. K. P. asks: If a large quantity of basswood shavings, kiln dried, mixed with green basswood sawdust, partially green, are stored in a large room at a depth of 8 feet, would the process of heating cause them to take fire? A. We should apprehend much danger from liability to spontaneous combustion.

(2) Theta.—Engines for utilizing the spent heat of exhaustion in vaporizing the highly volatile liquids, bisulphide of carbon, ether, and ammonia, have been built and large sums have been spent in endeavors to make them a success, but so far every form of combination has been a practical failure. The volatile liquids of the above class are exceedingly dangerous from tendencies to create fire or to suffocate persons exposed to their pungent odors. The use of gasoline in a vapor engine is now being introduced for running small laundries. This also requires great care, as leaky joints may cause serious trouble by igniting from the boiler fire.

(3) A. B. C. asks if a thoroughbred horse does not have one more rib than an ordinary horse. A. Certain horses have 19 ribs; while others have only 18, but we do not think that there is any rule by which you can claim that the horse having the greater number of ribs is any better than the other.

(4) J. A. H. asks: Is there any means of preventing rain water stored in wooden cisterns from becoming foul? A. Use charcoal of about the size of beans, with the dust sifted out, with which cover the surface of the water in the cisterns. This is the only antiseptic that we can suggest that does not interfere with the use of the water for all purposes. The cistern may be much improved, at the next cleaning, by washing the wooden surfaces, sides, bottom, and top, perfectly clean, and brushing a thin coat of pure Portland cement all over the surfaces. Mix quickly with water to a creamy consistency, and spread with a whitewash brush. Let it set for a few hours and go over it again. In one day the cement will be set and the cistern ready for use.

(5) D. C. S. asks: 1. Is there any wash that I can use to wash lime stains out of oak? A. No. 2. Is there any kind of wash that I can apply to oak or cherry to prevent lime and plaster from staining them? Coat them with paraffin, and the lime will not go through.

(6) Gloss asks how to manufacture a good liquid polish or gloss for shoes. A. We presume you desire a gloss for shoes. Take of gum shellac ½ lb., alcohol 3 quarts, dissolve, and add camphor 1½ oz. and lamp black 2 oz. For details as to combination and other information, with numerous receipts, see John Phin's "Trade Secrets and Private Recipes," which we can send you postpaid for 60 cents.

(7) W. S. P. asks: 1. How many pounds weight will a cubic foot of air, in an air-tight vessel, sustain on the surface of water? A. About 62½ lb., less the weight of the inclosing vessel. 2. How many pounds weight will a cubic foot of vacuum sustain, with same conditions? A. The same weight plus about 535 grains. 3. Is the power of a cubic foot of compressed air to sustain weight on the water greater or less than the natural air? And if so, in what proportion? A. Less in proportion to the pressure. 4. Is there any gas, or other thing known, which possesses greater buoyancy or weight-sustaining power on water than air, natural or compressed, or a vacuum? If so, what is it? A. A vacuum possesses the greatest buoyancy, surpassing that of air by the trifling amount indicated in answer No. 2; hydrogen comes next.

(8) F. A. C. writes: Will you please explain the following phenomenon: In our station barometer I have noticed that from time to time an increasing number of very minute specks of quicksilver form above the mercurial column, and attach themselves to the inside of the tube, looking like fly specks. A. Possibly the tube contains air bubbles, which, as they work their way up through the mercury and burst, carry up the minute particles you allude to. If so, your vacuum is becoming impaired.

(9) G. A. H. writes: I wish to have made several cells of Lalande and Chaperon's oxide of copper batteries as described in Hospitalier's "Domestic Electricity for Amateurs" (C. J. Wharton), but desire further information upon the following points not given in the description: 1. Will commercial caustic potash do, or must it be the C. P. kind, such as is used by pharmacists in the preparation of liquor potassa? A. Use commercial caustic potash. 2. What is meant by oxide of copper, the black (cupric) or the red (cuprous) oxide? A. Black or cupric oxide of copper. 3. What do you understand by the expression "the transformation of the potash into the oxide of zinc," etc.? A. The potash dissolves the oxide of zinc. 4. Will this battery (Fig. 11 for instance) answer perfectly for minor cautery, and furnish a current of sufficient capacity to make it at all times reliable? A. Yes. 5. Will these elements suffer by long periods of time in open circuit, say one or two months of continuous disuse? A. No.

(10) C. S. W. asks: What will prevent a full nickel bicycle from tarnishing or rusting at the seaside? Is there any substance which will not gather the dust, and that can be easily removed? A. This is a constant trouble wtih nickeled parts of bicycles. We can only suggest vaseline. Address some dealer in bicycle supplies, who may be able to offer a more efficient anti-rust material.

(11) F. B. C. says he is troubled in obtaining sufficient density in his negatives. He employs a Seed plate and a ready prepared single solution developer. Exposing instantaneously or up to five seconds, he obtains no better results. A. Probably the developer contains hydro-quinone, and works slower than pyro. You do not let the plate remain in the developer long enough. Half an hour is not too long, if the plate has been instantaneously exposed, and five minutes is not too short for a fairly exposed plate. You will save time and trouble by consulting a photographer in your locality. These images are due to too short development, over-exposure, or to too little pyro. or hydro-quinone in the developer.

(12) F. H. asks: How much mercury in an half inch brass tube (half inch diameter) will be required by an application of heat, to raise a piston weighing 4 ounces, and what is the maximum of heat the mercury will stand? A. You cannot use mercury in a brass tube, as it will destroy the brass. Any amount will raise such a piston by the application of any degree of heat. You may heat it to about 600° Fah., before it will volatilize. Its expansion by heat is very slight, and, under conditions named, is too slight to be of much practical use.

(13) A. G.B. asks: Is there any substance which will prevent and stop fermentation in apple cider or other fruit juices? A. Sulphur burned in the barrel has the desired tendency. A stick may be coated with melted sulphur, lighted and held in the half filled barrel, which is shaken to cause absorption of the gas.

(16) T. H. C. desires instructions for some sort of a sizing, such as is used on campaign flags to stiffen them up and put on a gloss. A. After the coloring has been printed, the flags are stiffened with starch size, and then passed through rollers.

(15) E. C. asks: Can lime be used to advantage with barn manures? If so, how? A. No; because it tends to set free the ammonia, which then escapes into the air.

(16) R. O. asks: Will you kindly tell me how I can remove the solder from platinum, so that it may be made comparatively pure. It is at present soldered to small German silver springs. Also, how I can utilize platinum filings? A. If gold-soldered, the solder cannot be removed without elaborate refining or melting at a high enough temperature to volatilize the gold. If brass-soldered, nitric acid will dissolve much of it. Sell the filings to dealers in platinum. It will not pay you to try to work them up.

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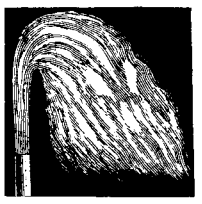

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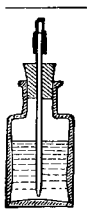

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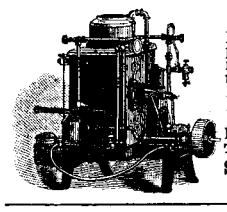

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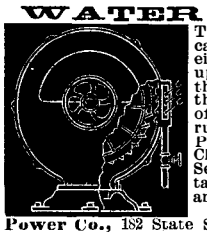

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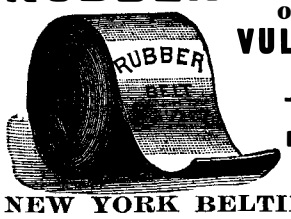

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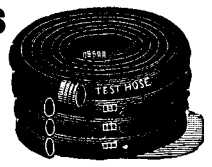

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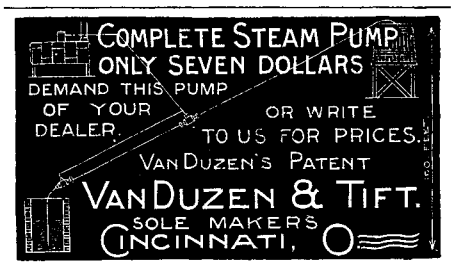

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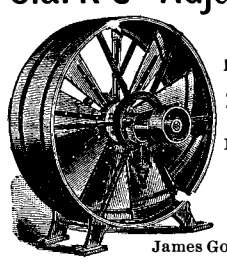

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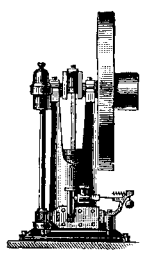

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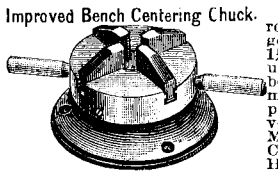

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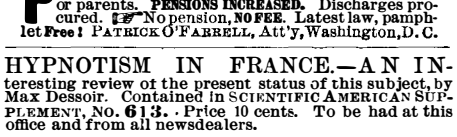

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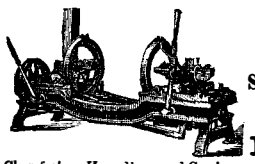

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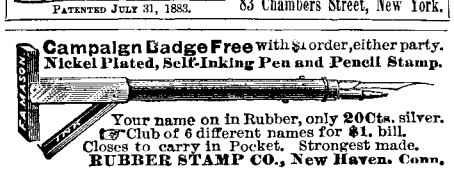

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JOHN MCCARTY, *President of the Board of Aldermen.*
Attest, DANIEL B. PHILLIPS, *Secretary.*

Coil-Boilers for the United States Navy.—NAVY DEPARTMENT, WASHINGTON, D. C., *August* 2, 1888.—The Navy Department, having in view the possible decrease in weight of machinery in vessels of war by the use of tubulous, sectional, or coil-boilers, has determined to adopt such boilers, if suitable can be found, for a portion of the steam-power of one or more of the vessels about to be built. To this end, manufacturers who wish to offer such boilers for use by the Department are hereby invited to furnish plans of the same adapted to an armored coast-defense vessel, on or before September 15, 1888. Plans must be accompanied by certificates that boilers of the same make are or have been in successful use at sea or on shore. Plans showing the space in the vessel available for boilers, particulars of the duty required, and other information, may be obtained upon application to the Bureau of Steam Engineering. The boiler which appears to the Department, after investigation, to be the best for the purpose, taking into account the evaporative efficiency, the dryness of the steam, the weight of the boiler, the weight of the water contained, the accessibility for repairs, the ease of making repairs, the simplicity and interchangeability of the parts, the space occupied, the ease of firing and of regulating the feed, the suitability for working in battery, the capability of long-continued steaming without cleaning, and the durability, will be adopted in the coast-defense vessel above mentioned, provided that the price, which must be stated when the plans are submitted, is satisfactory to the Navy Department. Such boilers as appear to possess merit will be tested by the Navy Department, if the manufacturers so desire, to determine which is the more suitable for the purpose. Manufacturers who wish their boilers to be tested must furnish a boiler of the type of one of those proposed for the vessel and prepare it for test, either at their own works or at such place as may be arranged with the Department. The expense of the test of the accepted boiler will be borne by the Navy Department, and the cost of the fuel used in the test of the second best will also be borne by the Navy Department. All other tests must be at the expense of the parties offering boilers for competition,

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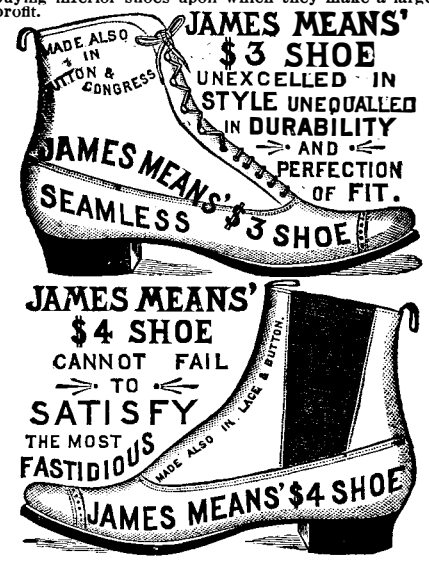
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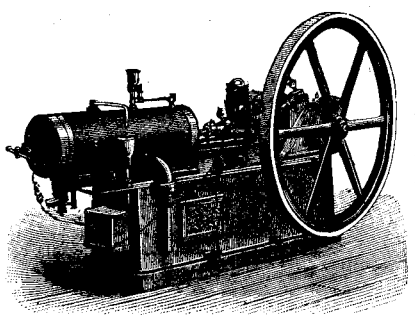

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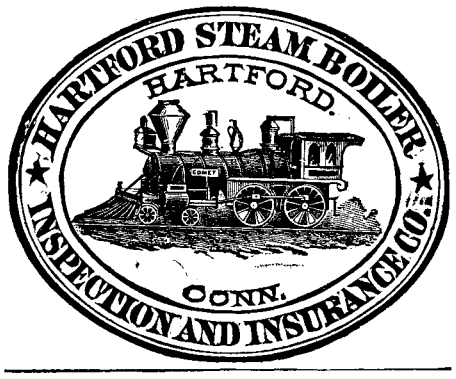

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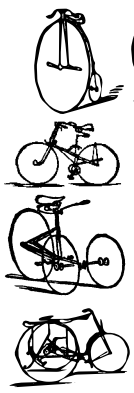

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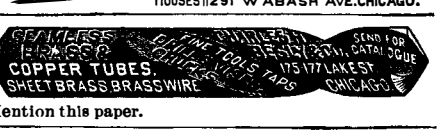

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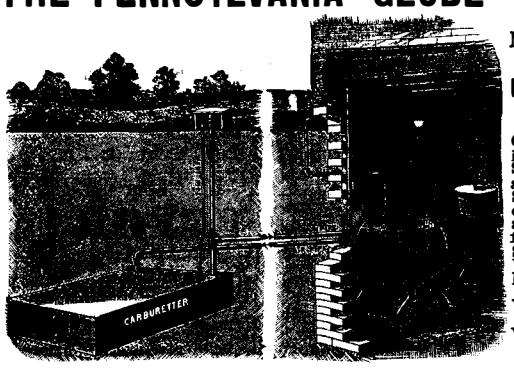

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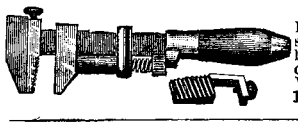

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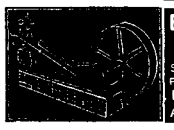

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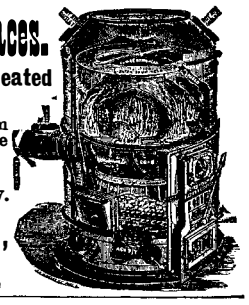

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